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J. M. Brown

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by the Revd Frederic Kendall
Vicar of Riccal near York
— who was tried for setting fire to Caius?
Cambridge immediately after graduating
& acquitted — He is now dead having
left a Widow & [illegible] 1852)

Lowndes says Francis Kendall

# A
# DESCRIPTIVE CATALOGUE
of the
# MINERALS,
(AND)
# FOSSIL ORGANIC REMAINS
OF
# SCARBOROUGH,
AND THE
# VICINITY.

SCARBOROUGH.
Printed by T. Coultas.
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## SCARBOROUGH AND THE VICINITY,

INCLUDING THE LINE OF COAST FROM HORNSEA TO MULGRAVE, AND
EXTENDING INTO THE INTERIOR AS FAR AS MALTON.

BIBLIOTHECA BODLEIANA

> Piscium et summâ genus hæsit ulmo,
> Nota quæ sedes fuerat columbis;
> Et superjecto pavidæ natârunt
> Æquore damæ.
> Horat. Carm. Lib. I, Od. II.

SCARBOROUGH:
Printed by and for T. Coultas, Newbrough-Street; and Sold by
Lackington, Allen, & Co., London; J. & G. Todd, and
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Malton; and Rodgers, Whitby.

1816.

Gough Adds Yorkshire
8° 123.

15857. [illegible]

# Advertisement.

*To a numeral catalogue of the minerals and extraneous fossils of Scarborough and the Vicinity, the subsequent work owes its origin. The number of species of the different genera, and the great beauty of the specimens which have been discovered on this coast, induced the adding of short characteristic descriptions to each, with reference to those of the best authors, who have treated on similar subjects. In this form, and under the idea of its possibly reflecting some light on a study which has of late engaged a peculiar attention, this work is humbly presented to the public.*

**Scarborough, March 19th, 1816.**

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# Part First.

# MINERALS.

A

# CATALOGUE, &c.

◆

## I. COMMON JASPER.

*Gemeiner Jaspis,* Werner.—*Common Jasper,* Kirwan, p. 310. vol. 1.—*Id.* Jameson, vol. 1. p. 238.

Colour, brown, red, and yellow, or variegated with any of these, disposed in clouded, spotted, or striped delineations. The brown passes into yellowish and liver brown, which latter passes also into blackish * brown ; the red † is blood-red, brick-red, brownish dark red; the yellow dull. Occurs in rolled pieces, generally perforated; traversed by quartz veins of various hues, sometimes the tinge is Amethystine; we find also in some of our specimens pyrites and plombaginous iron ore. Fracture, more or less conchoidal; passing into earthy and even; opaque; rarely translucent on the edges. Lustre, dull, sometimes glistening; hardness, various; not difficultly frangible. It is to be met with all over the coast; some specimens take a tolerable polish, the metallic ones have considerable beauty.

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* Most probably the black marbly Jasper, which Sir John Hill found on this coast, belongs to this species. See Hill on Fossils, p. 592.

† Sowerby's British Mineralogy, Vol. III. Tab. 218.

## II. JASPER AGATE. *

*Agat Jaspis,* Werner.

Colour, brownish red, brownish yellow, or yellowish white, arranged in ring-shapen or fortification veins. Fracture, small and imperfectly conchoidal. Translucent on the edges, sometimes opaque. Hard. Occurs in agate in the intervals between the concentric lines, and not unfrequently composes the major part of the specimen. To be met with in Carnelian and Mill bays, Scalby sands, &c.

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* The term Jasper-Agate, has been applied to all Agates that are loaded with Jasper, assume what form it may—Moss-Agates come under this denomination, and particularly so, when the arborations or markings of the Jasper are numerous.

## III. PORCELAIN JASPER.

*Thermantide,* Haüy, p. 510, vol. 4.—*Jaspe porcelaine,* Borchant, p. 166, vol. 1.—*Porzellan Jaspis,* Wern.—*Porcellanite,* Kir. pp. 313, 314, vol. 1.—Jam. p. 236, vol. 1.

There is a diversity of colours, which mineralogists assign to this beautiful variety of Jasper: here we have discovered but two, the lavender blue, which sometimes passes into a green shade, and the dark red. These colours are never mixed or clouded together. Occurs in rolled and angular pieces. Fracture, imperfectly conchoidal, nearly even.—Lustre, glimmering. Rarely slightly translucent on the edges. Particularly brittle. It is very rare here, and is found in small pieces: those we have seen have been found on the sands of Hornsea, Bridlington, and Gristhorp.

## IV. STRIPED JASPER.

*Band Jaspis,* Wern.—*Le Jaspe rubane,* Broch. p. 334, vol. 1.—*Ribband Jasper,* Kidd, p. 207, vol. 1. *Striped Jasper,* Kirw. vol. 1, p. 312.—*Ibid.* Jam. p. 233, vol. 1.—Sowerby's *Brit. Min.* vol. 2, tab. 157, p. 109.

This stone presents various colours in the same specimen, as grey, green, yellow, red, and white, and these distributed almost universally in straight, and very rarely in concentric stripes; sometimes in spots.* The colours assume various shades. The green passes into mountain and leek-green. Occurs in flattish pieces. Lustre, internally dull. Opaque. Fracture, imperfectly conchoidal—the compactness or density of the bands or stripes not always being uniform, makes the fracture in some specimens, to vary considerably. Not particularly hard, may be sometimes scratched with the knife. We find it here in great variety and plenty. It has been thought by mineralogists, and with great reason, to be akin to hornstone.

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* Specimens of this are met with here beautifully and irre-

## V. HELIOTROPUM.

*Heliotrop*, Wern.—*Jaspe sanguin*, Haüy.—*Heliotrope*, Jam. vol. 1, p. 178 —*Heliotropum*, Kirw. vol. 1, p. 314.—*L'Heliotrope*, Broch.—*Bloodstone*, Kidd, vol. 1, p. 210.

Its colour for the most part is between glass and leek-green, sometimes dark mountain green, sometimes lighter, or approaching to a blackish green. Rarely occurs here dotted with red spots, generally with yellow. Fracture, conchoidal, sometimes coarse splintery. Fragments, sharp edged. Lustre, glistening. Occurs in rolled pieces. Translucent on the edges; sometimes the specimen when cut into slabs is translucent. Mr. Kirwan observes that this species is evidently, nearly allied to Jasper, and often differs only by the aggregation of its properties; its fragments sharper, and its transparency often much greater. *

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gularly speckled with a bright leek green, and grey, and take a good polish.

* We meet with here a species of Jasper, forming a complete anti-bloodstone, the whole specimen being a deep blood red, dotted with small circular spots of green; this takes an

cularly easily frangible. When pulverized, still retained its black colour, which was the case also when it was heated. Occurs in various parts of the coast, has no peculiar situation. It is said to have been found in the province of Lydia, in Asia-minor, hence its name. When polished, it is used for a touch-stone to ascertain the purity of gold and silver.

### VIII. PETROSILEX, OR CHERT.

Colour, white and grey: of white, it presents bluish white, and reddish white: of grey, whitish grey, and reddish grey. It has by some been considered as an unmatured Agate; and has by others been classed under chalcedony, as an impure, or imperfect species of it. It certainly has much the appearance of chalcedony, particularly the bluish variety. Occurs massive, sometimes in nodules, rarely in rolled pieces. Sometimes extremely porous. Contains and composes in many instances, Alcyonites, Corallites, Trochites, &c. The bluish and milk white chert, we have observed at Malton, is compact, often blistered like chalcedony, commonly with calcareous dog-tooth chrystals. It is contained frequently in the nodules which the quarry-men, near Ayton, call 'round-heads.' Lustre, of the pure sort of Malton, glistening; of the coarser, dull. Fracture, of the purer sort, imperfectly conchoidal; of the porous, straight and even, bordering sometimes on hackly. Opaque; very faintly translucent on the edges. Difficultly frangible; tolerably heavy. The pure sort rarely occurs on the coast, the porous is not uncommon here.

## IX. FLINT.

*Feurstein,* Wern.—*Quarz, agathe, pyromaque,* Haüy.—*Silex, ou Pierre a fusil,* Broch. vol. 1. p. 263.—*Flint,* Kirw. vol. 1, p. 301.—*Id.* Jam. vol. 1, p. 169.—*Id.* Kidd, vol. 1, p. 211.

*Its most common colour* is grey, of which it has the following varieties, ash-grey, yellowish grey, reddish grey, bluish grey, greyish black. Of yellow, it presents ochrous yellow, wax-yellow; of brown, reddish brown, yellowish brown; of red, intermediate between flesh and blood-red; also greyish or bluish white; and sometimes it has a greenish hue. The delineations * of the colours are various, as zoned, striped, flamed, clouded, dotted—Amorphous; frequently in nodules, which are sometimes hollow, containing pyramidical chrystals of transparent quartz; it is also ramified, and occurs in pear-shapen, elliptical, rolled and angular pieces, these are often perforated. Flint forms the substance of the various extraneous fossils of Bridlington-bay, as echinites, alcyonites, &c. and sometimes tubiporites and madreporites. The exterior surface is for the most part rough, pitted and uneven, and incrusted or coated with indurated chalk or chalcedony. The surface of fragments and of some rolled pieces is tolerably smooth. Internally, the lustre is glimmering. Fracture,

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* There is almost an infinite variety of delineation in our specimens, sometimes we find them elegantly marked with

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alternate stripes of yellow and black, black and dark red, &c. also with flamed or irregular stripes of red, yellow, and green, upon light-blue and dead-white bases. The blue will frequently be seen variegated with black, after the manner of landscape-marble. The ochrous yellow also, which verges into a brown, presents fortificationwise, or clouded markings, greatly resembling Ægyptian Jasper; some of these are very elegant; imagination leads us to discover in them various figures, as human faces, animals, &c. Many of our smaller flint-pebbles are beautifully variegated by irregular markings of red, green, yellow, and grey, disposed concentricwise, and extremely vivid. See those figured by Sowerby, Brit. Min. vol. 3, tab. 220, and vol. 1, tab. 88.

perfectly conchoidal. Fragments indeterminately angular, and very sharp edged. The yellow, reddish, and whitish varieties are generally translucent; the ochrous yellow, wax-yellow, blackish and bluish white are sometimes translucent on the edges, but are for the most part opaque. Hard; easily frangible. Heated, it decrepitates, changes colour, and becomes opaque. The chalcedonic varieties occur at Flamborough-head, in extensive stratified masses, alternately with Chalk-Stone. Flint, in all its varieties, is to be distinguished from all other species of the silecious genus, by its almost perfectly conchoidal fracture, by its readiness in giving fire to steel, by its easy frangibility, and by its sharp edged fragments.

## X. CHALCEDONY.

*Gemeiner kalzedon,* Wern.—*Quarz, agathe, calcedoine,* Haüy.—*La Calcedoine,* Broch. vol. 1, p. 268.—*Common Chalcedony,* Jam. vol. 1, p. 174.—*Id.* Kirw. vol. 1, p. 298.—*Chalcedony,* Kidd, vol. 1, p. 217.

Colour, generally grey, of which it exhibits bluish grey, which sometimes passes into bluish white, and this into milk-white; also smoke-grey, greenish grey, yellowish grey. Occurs in rolled pieces seldom of considerable size, also stalactitic, * mammillated, and forming the petrifying matter of various organic-remains, as ammonites, ammonoides, and numerous shells; also of madreporites, and tubiporites, † &c. Fracture, even, flat conchoidal, and fine splintery. The lustre, when passing into quartz, is dull; when the fracture is imperfectly conchoidal, the lustre will generally be found to be glimmering. Fragments, indeterminately angular and sharp-edged. Surface, generally rough and uneven, often invested with drusy quartz. Translucent, sometimes highly so. Harder than quartz. The flint in the neighbourhood of

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* This variety of chalcedony has also been called skeleton-chalcedony, from its resemblance to an agglutinated mass of small cylindrical bones of birds, &c. It is a remarkable fact, that a gentleman of the faculty, a visitor here, discovered in a specimen of this variety which he found near the nabb, the outward appearance of the first joint of the human great-toe, the nail, &c. entire; on making the necessary sections, he discovered a resemblance of the bone and other appendages in their proper situations.

† The extraneous fossils abovementioned, when composed of chalcedony, are not of common occurrence here; several elegant and highly valuable specimens have been met with, and tolerably translucent.

Flamborough, is strongly chalcedonic, and particularly so in the cave called 'china-hole.' Mr. Kidd, in his outlines of Mineralogy, observes, "The derivation of chalcedony from the common black flint, may be traced by very delicate gradations, sometimes in the same specimen; for upon breaking a nodule of the flint, a cavity is not unfrequently discovered, the surface of which, consists of irregularly blistered chalcedony, the substance of the flint passing insensibly into that of chalcedony." It will frequently be discovered in amygdaloid, in balls. It is to be found in the limestone quarries of Ayton and Malton, on the shores of Bridlington and Scarborough, in all its varieties. The name chalcedony is derived from Chalcedon, in Bythinia, where the fossil was first found. It takes an excellent polish.

## XI. QUARTZ.

*Quarz*, Wern. and Haüy.—*Quartz,* Kirw. vol. 1, p. 242.—*Le Quarz commune,* Broch. vol. 1, p. 248. *Common Quartz,* Jam. vol. 1, p. 152.

The most prevailing colours are white and grey; of white; we have observed milk white, bluish white, yellowish white,and reddish white; of grey, we have seen ash-grey, and smoke-grey, which latter passes into greyish black. The greyish shades appear chiefly in granites and other aggregated stones. Occurs, chrystallized, disseminated, granular, in blunt-edged, and rolled pieces. Frequently much corroded and cellular; it also occurs with impressions, and particularly those of the euphorbium. The chrystals are the six-sided pyramid, seldom of great size; and for the most part are to be found in nodules of flint, agate, or chert; as at Malton, and in the quarries of Ayton, Seamer, &c. Quartz is generally translucent, the chrystallized varieties are semi-transparent. Lustre, more or less vitreous. Fracture, fine or coarse splintery. Scratches glass; does not yield to the knife. Tolerably hard. Brittle. When two pieces are rubbed together, they become phosphorescent. It passes into flint, carnelian, chalcedony, silecious shistus and sand-stone. It is uncommonly abundant here, and in every part of our coast.*

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* Many of those rounded pebbles which we see strewed on the beach, and which, when wet, are translucent, and when dry, are comparatively dull, are quartz; the colour of these stones is chiefly pale yellow, reddish, or milky white.

## XII. AMETHYST.

*Gemeiner Amethyst,* Wern.—*Amethyst,* Kirw. vol. 1, p. 246.—*Common Amethyst,* Jam. vol. 1, p. 137.—*Chrystallized Amethystine Quartz,* Kidd, vol. 1, p. 200.

Colour, violet blue; Occurs here chrystallized only. The chrystals are pyramidical, small in size, and occur in agate nodules. Semi-transparent. The external lustre of the chrystals borders on splendent, internally, it is vitreous. Fracture, splintery, inclining in the best specimens to conchoidal. Yields to the file. It is not common here; but several good specimens are in the cabinets of the curious.

## XIII. COMMON GARNET.

*Gemeiner Granat,* Wern.—*Common Garnet,* Jam. vol. 1, p. 69.—*Id.* Kirw. vol. 1, p. 259.

Colour, black, or blackish green. Occurs here chrystallized, in rhomboidal dodecahedrons. The chrystals small, surface glistening, sometimes shining. Slightly translucent, and when held to the sun, appears reddish-brown. Lustre of the fragments, vitreous. We have not been able to determine the fracture. Sometimes scratches glass, rarely quartz. It has hitherto occured in mica-slate only, though it probably may be discovered in the gneiss of the coast.

## XIV. BERYLL.

*Edler Beryll,* Wern. *Aqua-Marine of many.—Beryll, and Aigue-Marine,* Kirw. vol. 1, p. 248.

Colour, principally sea-green, or greyish green; when the colour inclines to a golden yellow, which has sometimes been the case on the coast, the stone is denominated chryso-beryll. Highly translucent, with numerous rents, sometimes slightly irridescent. External lustre, shining; internally it is the same. Cross fracture, imperfectly conchoidal; the longitudinal one has a fourfold cleavage, and is foliated. Occurs in smallish rolled pieces, which are rare. Hard; scratches glass with ease; scratches quartz with some difficulty. It is usually accompanied with quartz; we have seen some specimens tolerably pure. It is slightly duplicating.

## XV. SCHORL.

*Common Schorl*, Jam. vol. 1, p. 121.—*Schorl*, Kirw. vol. 1, p. 265.—*Le Schorl noir*, Broch. vol. 1, p. 226.—*Tourmaline noir*, Haüy, vol. 3, p. 31.—*Tourmaline*, Kidd, vol. 1, p. 233.

Its colour is black of various shades, sometimes slightly inclining to greenish black. Occurs, in quartz, either in very thin and minute plates, or in scopiformed and divergingly* pseudo-chrystals, longitudinally striated. Fracture, in the cross direction, borders on conchoidal, the longitudinal one is foliated. It occurs also in shistose-mica, in acicular chrystals of a velvet black and shining. Gives a greyish streak; scarcely so hard as quartz; seldom ever here passes into tourmaline. By some it has been said to derive its name from a Swedish word *Schorl*, which signifies brittle, by others, from the village of Schorlaw in Saxony, where it was first found.

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* This we conceive to be the pointed schorl, figured by Sowerby, Brit. Min. vol. 4, tab. 359.

## XVI. CARNELIAN.

*Karniol,* Wern.—*Carnelian,* Kirw. vol. 1, p. 300. *Id.* Jam. vol. 1, p. 178.—*La cornaline,* Broch. vol. 1, p. 272.—*Achates carneolus,* Wall. vol. 1, p. 185.—*Quarz-agathe cornalinc,* Haüy.—*Carnelian,* Kidd, vol. 1, p. 226.

Colour, principally blood-red, of which it presents various shades, passing from deep blood-red to pale red, thence to orange-red and pale yellow, and into yellowish white and milk-white. Some varieties pass into reddish brown. These colours often occur in the same specimen, either in gradation, or in clouded, zoned, spotted, and dendritic delineations. The specimen will frequently be found envelloped in a brownish opaque crust. We commonly find it in rounded and blunted angular pieces; it will be discovered also in layers in agate. The exterior of this stone is, for the most part,* rough and pitted, sometimes tolerably smooth. Fracture, conchoidal. Lustre, glimmering; semi-transparent, often translucent only. Some varieties have a fortificationwise tendency. The red colour of the carnelian, without doubt, proceeds from the infiltration of Iron. The term carnelian is derived from the Latin word *caro,* signifying flesh. It will be found on the beach for a considerable extent along the shore.

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* Mr. Sowerby observes, "The agates found on the sea-coast, being rolled and jumbled together by the force of the waves, are roughened, but being hard this roughness penetrates but a little way, and the utmost force they experience seems

## XVII. AGATE.

*Agate,* Jam. Kirw. Kidd.—*Achates* of the ancients.

[*] Agates, as Mr. Werner justly remarks, do not form a distinct species of stone, but consist of quartz, crystal, hornstone, flint, chalcedony, amethyst, jasper, carnelian, heliotropum, jade, aggregated in binary, ternary, or more numerous combinations, and susceptible of a good polish; even one of these, if it present two or more colours, and assume a good polish, is called an agate. These

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only to make little circular flaws, or, if I may be allowed the expression, more frequently little crescents or semi-circular flaws, from the impulse of the blow coming in a lateral direction." Brit. Min. vol. 1, p. 170.

[*] Kirwan's Min. vol. 1, p. 330.

mixtures present either dots, veins, zones, filaments, figures of various kinds, ramifications or arborizations. Agate occurs here in blunted-angular, sometimes in nodular masses. The colours are, the clear yellowish, reddish, milk, or greyish, or bluish white, or pearl-grey, or honey, ochre or orange yellow, flesh, blood, or brick-red, or reddish brown, violet-blue, or brownish green.

| | |
|---|---|
| The clear pellucid white denotes | Crystal or quartz, |
| The yellowish white, | Amethyst, chalcedony, |
| The greyish white, | Quartz, |
| The milk-white, | Jasper, amethyst. |
| The yellowish grey, | Quartz, flint. |
| The smoke-grey, | Chalcedony, flint. |
| The pearl-grey, | Chalcedony. |
| The greenish grey, | Chalcedony, jasper. |
| The bluish grey, | Chalcedony. |
| The honey-yellow, | Flint, jasper. |
| The yellow, | Jasper. |
| The ochre-yellow, | Chalcedony. |
| The orange-yellow, | Chalcedony. |
| The yellowish brown, | Carnelian. |
| The reddish brown, | Hornstone, carnelian. |

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| The flesh-red | denotes | Carnelian. |
| The blood-red, | | Jasper, carnelian. |
| The brick-red, | | Jasper. |
| The violet-blue, | | Amethyst. |
| The leek-green, and feeling somewhat greasy, | | Jade. |
| The browish green, | | Heliotropum. |

The following varieties of Agate have been met with on the coast,

1. Fortification Agate. 2. Tube Agate. 3. Moss Agate. 4. Landscape Agate. 5. Clouded Agate. 6. Riband Agate. 7. Zoned Agate. 8. Petrifaction Agate. 9. Jasper Agate. 10. Sand Agate. 11. Fragment or brecciated Agate.

1. FORTIFICATION AGATE is formed by the laminæ being so disposed, as to form salient angles resembling a fortification; it is to be met with here of various colours; those of the lines, laminæ, or veins, are generally white of different shades, or red. The central part of the agate, round which the laminæ are formed, is often of a pure chrystalline quartz; indeed quartz enters so much into the composition of many of our agates, that it detracts greatly from their value. We find agates of this

description beset with numerous small concentric circles of various hues, resembling eyes, hence the name of eyed agate.*

2. Tube Agate, or Tubular Agate, has its name from being pierced by small straight chalcedonic, or carnelian tubes, arranged in a parallel, or slightly diverging manner, not unlike the bristles of a brush; sometimes the tubes are placed without any order. The cavities of the tubes are, for the most part, filled with jasper of a blackish, or dingy brown colour, sometimes inclining to reddish brown, and not unfrequently filled with opaque milk-white chalcedony. In the case when the erect tubes are connected by curved horizontal ones, the agate is not to be denominated tubular, since this construction evidently belongs to the tubiporite. The tubular formation of this agate, is of stalactitic origin, though many of the tubes bear great resemblance to acicular spines. The basis is either a clouded white, or a clouded bright yellow, tolerably translucent. The matter filling the tubes is frequently found in a state of decomposition. It is by no means common here.

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* Sowerby's Brit. Min. tab. 160, vol. 2.

3. Moss Agate. Jasper, under the assumed forms of moss, leaves, feathers, filaments, coral, tufts, &c. is here seen swimming, as it were, in a silecious basis, which is chiefly chalcedonic. The arborizations, &c. are in many specimens very distinct, while in others they are clouded and run into each other, forming blotches, which have a muddied appearance. The colour of the moss, &c. is either red of various shades, green, yellow, brown, or black. These colours either occur singly in the same specimen, in gradation, or promiscuously mingled together. The colour of the basis is, for the most part, a clouded white or pale yellow, variously translucent. Mr. Kirwan * remarks that some (agates) contain moss, or other herbs, and quotes M. D'Aubenton in the Mem. Paris, 1782. p. 668. Moss Agates, and those of considerable size and beauty, have hitherto been met with here very plentifully, and particularly so in the neighbourhood of Speeton.

4. Landscape Agate exhibits, on a basis which is mostly opaque, dendritic delineations, imaginary figures, &c. its component parts are probably hornstone, jasper, and chalcedony.

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* Mineralogy, vol. 1, p. 331.

5. **Clouded Agate.** The markings in this agate are clouded, the different shades of colour gradually running into each other. The white varieties of agate are generally of this species, presenting clouds of various degrees of opacity. The tinges of colour are numerous, as bluish, reddish, yellowish, greenish, &c. It is not rare here.

6. 7. **Riband Agate** and **Zoned Agate** are the same, the difference being produced by the direction in which the stone is cut. When it is cut perpendicularly or obliquely to the layers of which the stone is composed, riband agate is formed; but, when parallel with the layers, it becomes zoned agate.

8. **Petrifaction Agate.** Wood or other substance which has been penetrated by the fossil forming agate, comes under this denomination. It is chiefly of a brownish or blackish colour, and is susceptible of an excellent polish. Among the varieties of petrifaction agate we enumerate agatized Roestone. The globular concretions are for the most part jasperine, but the basis is silecious; it has sometimes plombaginous iron-ore intermixed.

9. Jasper Agate has been already described.

10. Sand Agate. Here the whole flinty basis is interspersed with sand or minute hollows, lined or filled with drusy quartz; chrystals, generally greyish, brownish grey, or yellowish in colour; sometimes the sand is irregularly veinous; but for the most part it is promiscuously scattered over the whole substance of the fossil. It is very common here, at Whitby, Bridlington, and Hornsea. Admits of a bad polish.

11. Fragment or Brecciated Agate. In this stone we discover fragments generally angular, in form of the various kinds of agate, carnelian, hornstone, &c. cemented by a basis of chalcedony or quartz, which is tolerably translucent. Good specimens are rare here.

## XVIII. MOCA STONE, or MOCOA STONE.

*Mochs-stein of the Germans, Achates Mochoensis,* Wallerius, vol. 1, p. 299.

The difference between the Moss agate above described, and the Moca stone is very slight. The basis of the latter, which is of a light brown honey-colour, or whitish, is more pellucid than that of the former; the arborizations also, are more thinly scattered, more distinct, and in colour are blackish, brownish, or greenish—It sometimes has small dots of red interspersed. When this stone is cut into slabs, and placed before the solar microscope, it exhibits a scenery highly interesting, as single branching trees or shrubs, impervious forests, &c. Specimens are to be found throughout the whole extent of the coast. It has its name because it was supposed to be originally brought from Mocha or Mocoa in Arabia; it is however said, that no stone of this species is found near Mocha, and that it has its name from the corruption of the German word *mochs*, which signifies moss.*

## XIX. ONYX.

*Onyx*, Wall.—*Id.* Jam. vol. 1, p. 177.

This species is considered to be chalcedonic.

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* Mr. Sowerby in his Brit. Min. vol. 1, p. 171, observes, "as yet we do not know of any stones worthy to be called Mocoas found in Great Britain," many of our specimens are, however, equal to any of those from the continent.

The variety of onyx which we possess, is the stratified onyx; it chiefly consists of strata of the greenish grey, which is nearly semi-transparent, the greyish white which is translucent, and sometimes opalescent. The strata or laminæ are alternate and straight, rarely in waved or irregular directions. The stone has its name from a variety which resembles the human nail in colour. It occurs in rolled and angular pieces; is susceptible of a good polish.

## XX. SARD-ONYX.

*Sard-onyx,* Jam. vol. 1, p. 180.

This is nothing but the white variety of Carnelian, or onyx, which alternates with stripes of white or red.

## XXI. SILICIOUS SCHISTUS.

*Gemeiner Kieselschiefer,* Wern.—*Common Flinty Slate,* Jam. vol. 1, p. 195.—*Silicious shistus,* Kirw. vol. 1, p. 306.—*Schiste silicieux commun,* Broch. vol. 1, p. 283.

Colour, dark bluish grey, or greyish black; sometimes it presents clouded delineations often traversed or intersected by veins of quartz, sometimes by agate. Occurs for the most part in blunt angular pieces, the structure tending toward the laminated, intercepting between the laminæ a reddish argillaceous earth highly impregnated with ferruginous matter; these laminæ vary from an inch, to several inches in thickness. Fracture, in the gross slaty, sometimes splintery, passing to uneven and imperfectly conchoïdal. Fracture of the single laminæ, fine splintery. Fragments, indeterminately angular, and sharp-edged. Lustre, dull or glimmering. Opaque, sometimes translucent on the edges. Hardness, nearly equal to that of quartz. Difficultly frangible, not particularly heavy. Of common occurrence here.

## XXII. WOODSTONE.

*Holzstein,* Wern.—*Le bois petrifie ou le Holzstein,* Broch. vol. 1, p. 259.—*Woodstone,* Kirw. vol. 1, p. 315.—*Id.* Jam. vol. 1, p. 166.

Colour, generally blackish brown,[*] from which it passes into bistre brown, and brownish white, it exhibits also bluish grey. Frequently betrays its pristine state by its branchy form or knots, &c.; internally, the fibrous texture of the wood is very evident, yet it is seldom continuous, being intercepted by blotches of quartz or agate, which latter is fortificationwise disposed. The continuity of the ligneous fibres is sometimes so much disturbed, that the fragments have been cemented in quartz or agate, much after the manner of breccia, without any order whatever; when this is the case, the fossil assumes a peculiar elegance. Fracture, imperfectly conchoidal. Lustre, glimmering. Hard. Takes a good polish. Very slightly translucent; commonly translucent on the edges. It is not of common occurrence.

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[*] This shade of colour sometimes runs in streaks or veins throughout the whole fossil, and in all probability is derived from the effects of bitumenization.

## XXIII. COMPACT FELSPAR.

*Dicher, feldspath,* Wern.—*Le feldspath compacte,* Broch. vol. 1, p. 367.—*Feldspath compacte bleu,* Haüy, vol. 1, p. 615.—*Compact felspar,* Jam. vol. 1, p. 276.—*Continuous felspar, felspar en Masse,* Kirw. vol. 1, p. 323.

Its colours are grey, white, and green. The varieties of grey, are greenish, smoke and ash-grey, of white, greenish and greyish white, and smoke-green. Occurs, imbedded in green porphry, chrystallized. Its fracture discovers a straight, foliated, or laminated texture. The lamellæ polished and shining; cross fracture, uneven, the lustre in this case is glistening and glimmering. Translucent, but sometimes only so on the edges. Easily frangible, not particularly heavy. We are not aware that it occurs in any of the aggregated stones, except green porphyry, which is by no means common.

## XXIV. DISINTEGRATED FELSPAR.

*Aufgeloster feldspath*, Wern.

Its colour is a yellowish and reddish white, passing into flesh-red, occasionally it is smoke or ash-grey. Occurs in rhomboidal imbedded chrystals. Internally, its lustre is glistening, glimmering, or dull. Fracture, foliated and laminated, frequently approaches to coarse earthy. A little translucent on the edges. Soft, sometimes very much so, never particularly hard. Easily frangible. Not heavy. Frequently very much decomposed, so as to be nearly in an earthy state. It forms a constituent part of granite and gneiss; in amygdaloid, it occurs in round balls of various shades of colour. The disintegrated state of this felspar, is owing, in many cases, to its exposure to the air, some have thought it has originally been so formed. That the salt-water hastens its decomposition very much, will be easily seen on inspecting many of the aggregated stones on the beach.

## XXV. ADULARIA.

*Adular,* Wern.—*Feldspath nacre,* Haüy, vol. 1, p. 606.—*Adulaire,* Broch. vol. 1, p. 371.—*Moonstone,* Kirw. vol. 1, p. 322.—*Adularia,* Jam. vol. 1, pp. 286, 287.

Its colour is a smoky greenish white, inclining to asparagus-green. When held between the eye and the light, presents a splendent azure-blue, faintly verging towards verdigrease-green, and dotted with minute grains of black-mica. Occurs in rolled, and sometimes in angular pieces. Always chrystallized in oblique four-sided prisms, obtusely bevelled at both ends, the chrystals heaped together. The interstices between them are filled up with mica or common felspar. Fracture, straight and foliated, displaying a striated structure. Lustre externally and internally, shining and pearly. Fragments, rhomboidal. Translucent; rarely semi-transparent. Hard; brittle; not particularly heavy. It is to be distinguished from Labradore stone, by always reflecting the same colour, when held between the eye and the light. Rifty. Takes a good polish: It is of common occurrence here. In order to determine whether the beautiful shade of colour mentioned above, originated from the infiltration of salt-water, we were induced to make the following experiment. A specimen of this fossil, not possessing the azure-blue reflection in the slightest degree, was put into one of those floating trunks,* which are moored off the harbour at Scarborough, for the purpose of keeping lobsters alive; by this means the stone was continually in salt-water; after it had remained upward of a year, it was taken out, and had acquired the characteristic reflection of Adularia in a very eminent degree. It derives its name from Adula, one of the summits of the mountain of St. Gothard in Switzerland, where it is found in great abundance.

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* Hullies.

## XXVI. CHALK.

*Kreide,* Wern.—*La craie,* Broch. vol. 1, p. 521. *Chalk,* Jam. vol. 1, p. 473.—*Id.* Kirw. vol. 1, p. 77.

Its colour is yellowish white, which sometimes inclines to snow-white. Occurs, massive, and as a crust covering flint. Dull. Fracture, earthy. Opaque. Soils the fingers more or less. Passes from moderately hard to soft. The harder kinds are called Chalk-stones. Easily frangible. Light. Effervesces strongly with acids. It is composed almost entirely of lime and carbonic acid. At Flamborough and Speeton, it alternates with flint, in strata of various thicknesses; the chalk at these places contains numerous silicious petrifactions, as echinites and alcyonites, particularly the fungiformed, and elongated species; also nodules of iron-pyrites, and a reddish brown ferruginous ochre in cavities. Near Bridlington Quay, and in the cliffs of Fraisthorp, Barmston, &c. we find chalk in the form of gravel, frequently cemented together; strata of this gravel run near the surface.

## XXVII. ROESTONE.

*Roogenstein,* Wern.—*L'oolite,* Broch. vol. 1, p. 529.—*Oviformed limestone,* Kirw. vol. 1, p. 91.—*Roestone,* Jam. vol. 1, p. 480.—*Id.* Kidd, vol. 1, p. 26.

Its colour, is chiefly a brownish white, but sometimes a darkish blue. Occurs massive. The whole substance of the stone is made up of a mass of fine minute globular, distinct concretions closely compacted together, resembling an accumulation of mustard, or poppy seeds, or the roe of a fish; hence the name. These minute spherules are probably of stalactitic origin, or the effects of chrystallization; on bisecting them it will be seen, that they are coated concentrically. It composes the limestone-rocks of Ayton, Malton, Seamer, &c.

## XXVIII. RADIATED LIMESTONE.

*Radiated Limestone,* Sowerby's Brit. Min. vol. 2, p. 139, tab. 174.

Its colours, are white, grey, brown, yellow, and black, and these are sometimes blended together in the same specimen. Occurs chiefly in rolled pieces. Fracture, cross-ways, hackly and foliated; the lustre is shining. The great fracture presents radiating prismatic chrystals, shooting from a common centre, and of a considerable length. Lustre, in this case, dull. Opaque. Easily frangible. Rather hard. Not particularly heavy. Frequently porous. It is common here.

## XXIX. CALC SPAR.

*Kalkspath,* Wern.—*Chaux carbonatee cristallisee,* Haüy, vol. 2, p. 127.—*Le spath, calcaire,* Broch. vol. 1, p 536.—*Common Spar,* Kirw. vol. 1, p. 86.—*Calc spar,* Jam. vol. 1, p. 488.

Its most prevailing colour, is white, but it has sometimes a yellowish or reddish tinge. Occurs here, massive, disseminated, investing, stalactitical, and chrystallized. In the limestone-quarries, the six-sided pyramid occurs, which is translucent; the external surface of the chrystals is sometimes shining, but for the most part it is dull. At Speeton, and its neighbourhood, dog-tooth* chrystals are to be met with. The variety which abounds near the castle-foot at Scarborough, presents cuneiformed chrystals, which are deeply striated; surface, dull; fragments of this are rhomboidal, and have a strong double refracting power. We meet with calcareous spar in thin lamellæ, in the alum-shale, in veins in iron-stone, forming a kind of the ludus helmontii, or septarium; in fossil-wood, and fossil-bones, &c.

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* Sowerby's Brit. Min. vol. 1, tab. 33.

## XXX. STINK STONE.

*Stinkstein*, Wern.—*La pierre puante*, Broch. vol. 1, p. 567.—*Swine stone*, Kirw. vol. 1, p. 89.—*Chaux carbonate fetide*, Haüy.—*Limestone, of a greyish black colour*, Kidd, vol. 1, p. 29.—*Stink stone*, Jam. vol. 1, p. 521.

Colour, for the most part dark, or blackish grey, or bluish black. Lustre, various, but dull in most instances. Fracture, various. Fragments, indeterminately angular, have a slaty tendency. Opaque. Neither particularly hard, brittle, nor heavy. Easily frangible. Its most distinguishing characteristic, as has been observed by Kirwan,* is an urinaceous, or alliaceous smell, which it emits when scraped, rubbed, or pounded; he adds, "It is generally presumed to contain some bituminous substance, and with good reason, though I could procure none from the specimen I tried by distillation, nor any air distinct from fixed air; for the air I procured from it, was easily absorbed by lime-water, but of fixed air, I found it to contain o. 45." Professor Jameson, from Vaugelin, says, besides lime and carbonic acid, which are its principal constituent parts, it contains hydr. sulphure, which is the cause of the smell it emits when rubbed. Dr. Townson,* says it is composed of carbonate of lime and petroleum; but this is more properly denominated bituminous lime-stone. It occurs principally at Whitby.

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* Kirwan's Min. vol. 1, p. 90.

## XXXI. ARGILLO CALCITE; or LANDSCAPE STONE.

Sowerby's Brit. Min. vol. 4, tab. 325.

This is a compact limestone, containing argillaceous, and sometimes silicious matter. It occurs here of various colours, as yellow, brown, greyish white, &c. presenting clouded, dendritic, and linear markings. These delineations are sometimes so arranged as to represent houses, rivers, mountains, trees, &c. hence the name. It is capable of a good polish; specimens of a large size have not as yet been discovered.

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* See his Philosophy of Mineralogy.

## XXXII. TROCHITAL, or ENCRINAL MARBLE.

This is a limestone, containing the remains of the encrinate imbedded, which are also calcareous. Resembles the Derbyshire marble, and takes in general, as high a polish. Sometimes it contains pyrites, which give it a blackish colour, but its general hue is greyish, or bluish. Internally, the lustre is shining. Fracture, hackly. It is of common occurrence here.

## XXXIII. FIBROUS GYPSUM.

*Fasriger Gips*, Wern. *Chaux sulphatie fibreux*, Haüy, vol 2, p. 266.—*Le gypse fibreux*, Broch. vol. 1, p. 122.—*Fibrous gyps*, Jam. vol. 1, p. 563. *Fibrous gypsum*, Kidd, vol. 1, p. 65.

It is invariably white, except when it has been discoloured by chalybeate water. Occurs in small detached masses. Internally, its lustre is shining, sometimes even splendent, silky, and pearly, often chatoyant. Fracture, parallelly fibrous, sometimes curved. Translucent, sometimes semi-transparent. Soft and sectile. Easily frangible. Does not decrepitate when heated; takes a good polish. It is used by plaisterers when prepared, for mouldings, casts, &c. It is not to be found in the district in any quantity.

## XXXIV. SELENITE.

*Fraueneis,* Wern.—*La Selenite,* Broch. vol. 1, p. 609.—*Chaux sulphatee crystalisee,* Haüy, vol. 2, p. 266.—*Broad foliated gypsum,* Kirw. vol. 1, p. 123.—*Selenite,* Jam. vol. 1, p. 567.

Colour, snow-white, passing into a greyish white. Occurs, chrystallized in oblique parallepopipedal,* or hexahedral tables, each of the lateral faces of which is bevilled, upon the whole the chrystals have a rhomboidal aspect. The planes are slightly ribbed. In many cases, several smaller chrystals will be seen shooting out from the parent one. The chrystals are frequently lenticular, and of considerable length, terminating abruptly; many of them very large. Translucent, soft, and sectile. A dull radiating film,* having a vegetable appearance, will be discovered in the centre of the lenticular chrystals, in a longitudinal direction. Lustre, shining, pearly. Fracture, perfectly foliated and straight, with one perfect, and two imperfect cleavages. Structure, lamellar.† Fragments rhomboidal. Easily split in the direction, of the great fracture into laminæ of any thickness. Difficult to separate in the cross direction. Flexible to a great degree. Some of the chrystals contain pyrites, and are irridescent.‡ Superb chrystals of selenite, are found in beds of blue loamy clay, near Knapton, on the edge of the Wolds. Minute shining pellucid chrystals will be found in the cliffs, near the Spaw, these are very soft, and flexible, and have a mild taste.

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* Sowerby's Brit. Min. vol. 1, tab. 67.

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* Sir John Hill's Nat. Hist. fol. p. 152, pl. 2.

† Sowerby's Brit. Min. vol. 1, tab. 68.

‡ Sowerby's Brit. Min. vol. 1, tab. 67.

## XXXV. INCRUSTATIONS.

Incrustations are formed by water strongly impregnated with particles of the carbonate of lime; by its continual dropping upon the surface of extraneous bodies, the calcareous matter gradually deposits itself, forming at first a filmy crust, which by the action of the air becomes hardened. Since the depositions are nearly uniform, the body after incrustation will retain its proper form. In the case when branches of trees, moss, or other perishable substances are incrusted, the calcareous particles so penetrate them, that the organic part is entirely removed, and we have an earthy mass, bearing the exact shape of the bodies we have mentioned; this has been commonly called petrifaction; but it is evidently nothing more than substitution. In general, however, the detritus of the vegetable matter is not completed before the incrustation is perfectly formed, but takes place sometime afterward, so that small branches and twigs of trees, after incrustation, present those agglutinated masses of hollow tubes, which are commonly procured from petrifying springs; these have been called Osteocolla by some, from the resemblance they bear to masses of bones. The exterior surface has sometimes a glazed appearance, but for the most part it is dull. Opaque. Brittle. Colour, brownish white. There are several petrifying springs in the neighbourhood, as at Cloughton-Wyke, Forge-Valley, Newton-Dale near Yeddingham, &c. Remarkably fine specimens of incrusted moss, twigs, &c. are to be obtained from the springs of the former place, a small inlet of the sea about five miles to the north of Scarboro'. The cliffs there are very high, rocky and craggy; the springs issuing from the top, deposit various vegetable matters upon the projecting shelves, which are there incrusted, forming huge masses, and falling at length below by their own weight.

## XXXVI. STALACTITE.

A Stalactite is a calcareous concretion formed either upon the exterior surface of the stratum, or of some cavity within it. The form which the stalactites of the district assume is chiefly that of an icicle. The substance of the stalactite is either completely sparry, made up of concentric cylinders, or of a loose and earthy texture; and this depends entirely upon the time of formation. Those which are sparry, are semi-transparent and translucent. Colours, whitish and yellowish; the greenish tinge which they assume is derived from recent vegetable matter. The others are dull, opaque, and earthy. Sometimes the stalactite is perforated, and perfectly tubular. Mr. Whitehurst* ingeniously accounts for this singular formation as follows:—"If a drop of water hangs from the roof (of a cave) and remains suspended, but nearly dropping, the aqueous particles evaporating from the surface thereof, sooner than from its internal parts, the mineral particles therefore unite on the surface of the drop, while the interior part remains fluid, the water thus detained is continually increasing, and gradually extends in length downwards. The process thus going on, frequently forms tubes, one or two feet in length, and about one tenth of an inch in diameter." Stalactites are to be found in the holmes or hollows behind the Castle at Scarborough, in the ridge of rocks dividing Carnelian from Mill-Bay, Cloughton-Wyke, &c.

## XXXVII. STALAGMITE.

The matter forming the Stalagmite is precisely the same as that of the Stalactite; in the one the impregnated water oozes through the incumbent strata very slowly; in the other with considerable rapidity, so that the earthy matter in the latter case, instead of being pendent, is deposited upon the floor of the cavern, and this forms what is denominated a Stalagmite. Form, chiefly mamillated. Slightly translucent. Colour, yellowish white. The exterior often exhibits small-pointed chrystals. Occurs in the holmes, at Hackness, Cloughton, Newton-Dale, &c. The botryoidal* masses of stone called pea-stone, are stalagmites; these sometimes occur here. Occurs in rolled, and flattened pieces. Colour, darkish brown. Internally the globules display a radiating structure, sometimes hollow. Opaque. Easily frangible. The concretions are sometimes spherical, often more or less indented by mutual contact.

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* Theory of the Earth, p. 31.

## XXXVIII. JADE.

*Gemeiner Nephrite*, Wern.—*Jade*, Kirw. vol. 1, p. 171.—*Common Nephrite*, Jam. vol. 1, p. 413.—*Jade*, Kidd, vol. 1, p. 110.—*Jade*, Haüy.

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* Sowerby, vol. 1, tab. 38.

Colour, leek-green, passing into greenish white. Occurs in rolled and blunted angular pieces. Translucent; feels greasy. Generally dull, sometimes has a glimmering silky lustre. Fracture, splintery. Yields to the knife. Difficultly frangible. Rather light than otherwise. Scratches glass, Several good specimens have been found on the shore.

## XXXIX. MICA.

*Glimmer*, Wern.— *Mica*, Kirw. vol. 1, p. 210 — *Id.* Jam. vol. 1, p. 341 —*Id.* Haüy.—*Le Mica*, Broch. vol. 1, p. 402.—Sowerby's Brit. Min. vol. 2, tabs. 180, 181.

The most prevailing colour is grey, of which we have brownish grey, and blackish grey; also yellowish, or reddish brown, silvery white, pinchbeck-brown, greenish black, gold-yellow, &c. Always found interspersed in, or associated with other stones. Fracture, perfectly foliated or laminated. Lustre, shining, between pearly and resinous, frequently pseudo-metallic. The thin plates are transparent; but the larger pieces are only translucent on the edges. Lamellæ may easily be obtained of extreme tenuity, flexible, and very elastic. The edges of the lamellæ will sometimes scratch glass. Smooth, but not unctuous.* Sectile. It is one of the constituents of granite, gneiss, and mica-slate.

## XL. SEPTARIUM.

*Ludus Helmontii.—Argilliferous Marlite*, Kirw. vol. 1, p. 99.—Sowerby's Brit. Min.—Sir J. Hill.—*Playfair's illust.* Hutt. *Theor.* p. 30, &c.

Colour, greyish white, sometimes bluish, passing into blackish blue, intersected in various directions by veins of calcareous spar, so that the whole bulk is divided into compartments which exhibit externally, pretty regular quadrilateral figures, sometimes pentagons, and various multilateral figures. The carbonate of lime presents minute chrystals, which give the septa a serrated appearance; its colour is generally yellowish white. Occurs in large orbicular masses. Tougher than common limestone; burns to buff colour. Van Helmont having first noticed this variety of marl, it has from that circumstance and its partitions, obtained the name of Ludus Helmontii. The best specimens have hitherto been discovered in the vicinage of Malton; it occurs also inthe Stow-brow, and Peak alum-works, at Whitby and Kettleness, and sometimes on the coast here. Mr Sowerby has figured a specimen, in which the marl has been washed out, leaving only the calcareous septa; we have never observed this here.

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* Mica is frequently here steatitic, this is the effect of decomposition.

## XLI. ALUM SHALE.

*Aluminous Shale,* Kidd, vol. 1, p. 189.—*Pyritaceous, or Alum clay,* Sowerby's Brit. Min. vol. 3, tab. 247.

Colour,* blackish blue passing into greyish black. Occurs in immense strata of considerable thickness, and divided into tabular and angular masses, the exterior of which is coated with an extremely thin crust of ferruginous matter of the exact colour of the common rust of iron. Fracture, commonly straight slaty, sometimes more or less waved; the great fracture sometimes exhibits a surface much like the coarse splintery; cross fracture uneven. Lustre of the great fracture glimmering, of the small, dull and earthy. Has a greasy feel. Soft, yields to the nail. Has a mild taste. Fragments tabular. Has frequently glistening particles of pyrites intermixed. When exposed to the air, effloresces and decomposes; sometimes is covered with a whitish tasteless powder. When rubbed, has an alliaceous smell, which is not very strong. Tolerably heavy. Contains many adventitious substances, as vegetable impressions, the remains of wood, innumerable fossil-shells, which are for the most part composed of pyrites, with a highly polished surface, jet, &c. It abounds on the north coast, as at the Peak, Stowbrow, &c. When properly prepared it is made into alum.

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* When pounded it is a greyish white.

## XLII. ALUM STONE.

Colour, black, inclining slightly to bluish black, always blacker than alum-shale. Fracture, fine earthy, has a tendency to the conchoidal. Hard. Easily frangible; heavy. Dull. Has a rough feel. Occurs in various shapes as nodules, in basaltiformed, columnar, polygonal, elliptical masses, &c. Fragments indeterminately angular, and sharp edged. When rubbed emits an alliaceous smell. It is called by the workmen at the alum-works, *Dogger*, probably from their opinion of its worthlessness. The nodules are frequently incrusted with pyrites, and contain in them the cornu ammonis, belemnites, orthoceratites, &c. When properly prepared by burning, grinding, &c. forms an incomparable cement, which indurates under water, and is now generally employed under the name of *Roman Cement*. It occurs in the forms abovementioned, in the strata of the alum-shale; sometimes it is to be met with, in various parts of the coast, and may always be distinguished from alum-shale by its hardness, fracture, feel, weight, form, &c. A species of aluminous stone occurs here, and in great abundance at the alum-works, the peculiarity of the structure of which deserves a separate description. It has been called cone coralloid by some. It occurs in amorphous or pseudo-chrystallized forms, chiefly in cones which are variously aggregated, sometimes regularly disposed in rows, or alternating with a second row, and fitting the apex of one cone in the space contained between two others having their bases on the same plane, and touching each other; sometimes the cones are hollow, and several are placed within a large one. The sides of the cones are jagged or ribbed in a direction parallel to the base. Colour, bluish grey. Feels greasy, and answers in other respects to the characters given of alum-shale, save that it is rather harder: we conceive the stone abovementioned to be the same with that figured and thus described by Mr. Sowerby.* "We so frequently find the figure of corallines or other organized substance, that we are often puzzled to account for them; some, however, are readily understood to be infiltrations taking place of them; and that before us has hitherto been considered in this light. I agree with Linnæus, that it is rather a stalactite formed under certain circumstances among other operations of nature which may be continued to a great extent. Mr. Martin observes, that a very large space in Derbyshire is of this formation. It is finely undulated; in other respects the cones run into each other, which will separate into a number of cones, more or less perfect if placed by the fire. From the present specimen I separated some cones by alternately wetting and drying; we do not know how minutely they may be divided. The fracture is like other compact calcareous marles, that are not governed by the conical formation. The present specimen contains so much pyrites dispersed through it, that it might be used as an alum-ore."

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* Brit. Min. tab. 149, p. 93.

## XLIII. AGGREGATES.

By these we understand stones consisting of grains, either angular, chrystallized, or amorphous, simply aggregated or inherent, or imbedded in various matrices. From the definition, it will readily be seen that this division of the mineral kingdom is susceptible of almost infinite variety. Few places, perhaps, present so many different species of aggregated stones as Scarborough and its vicinity. The multiplicity of colour arising from decomposition, and the different proportions of the component parts, render even innumerable varieties of the same species. We shall on this account be as particular as possible in our descriptions; and we trust, from the great variety of specimens in our possession, which have cost several years collecting, we shall be able to bring into notice the most perfect, if not the most interesting branch of the mineralogy of the coast.

The species are as follow :—1. Granite, with its varieties. 2. Gneiss. 3. Grenatine. 4. Schistose-

Mica, or Mica-Slate. 5. Grunsten. 6. Granilite. 7. Porphyry, with its varieties. 8. Amygdaloid. 9. Pudding-Stones. 10. Sand-Stones, with their varieties.

I. Granite. *Granit,* Wern.—*Roche Feldspathique,* Haüy.—*Granite,* Jam. vol. 3, p. 101.—*Id.* Kirw. vol. 1, p. 339.

Is a compound granular aggregated rock, composed of quartz, felspar, and mica, all in variable proportions; sometimes one of them predominating and sometimes the other. The felspar is generally in the greatest proportion, the mica in the least. The constituents differ considerably in their size, from very minute particles almost approaching to sand, to pieces of an inch and a half long; but this is to be understood for the most part of the felspar.

Of Granite, containing the three grand constituents, quartz, felspar, and mica, we possess the following varieties.

1. Common Granite, or that containing the greatest preportions of each constituent. 2. Decomposed Granite. 3. Chrystallized Granite, or

when the quártz and felspar are chrystallized. 4. Porphyritic Granite. 5. Graphic Granite.

1. Common Granite. The felspar in this case is flesh-red, passing to reddish white; and it is to be remarked that the colour of the granite depends principally upon the felspar; fracture foliated; lustre shining. Rather hard. The size of the grains alternate from large to small. The mica, blackish and shining, may be taken for Schörl. Chiefly in amorphous specks, sometimes in nests. The quartz is greyish white, translucent. Lustre. glassy. The constituents being intimately blended together, it is compact, and sometimes takes a tolerable polish Occurs frequently in the cliffs and sands in large shapeless blocks.

2. Decomposed Granite may be any of the varieties of granite, but it is almost needless to remark, that the small grained are most liable to decomposition. The felspar in this case becomes brick-red; earthy, and soft, losing all lustre and transparency. The quartz never decomposes. The mica, loses its lustre, becomes earthy, and generally has the green appearance of chlorite earth;* sometimes it

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* The Mica becomes steatitic by decomposition.

is mud-grey. The exterior is commonly pitted and porous, the specimen should always be broken to come at the constituents, as there is nothing outwardly to be seen but the quartz. Whether the felspar, in any stage of decomposition, has ever passed into porcelain earth, we have had no opportunity of determining. The above is a general description of decomposed granite; but it may, and does present varieties, which differ as to the colour of the constituents: the exposure to sea-water, and the being in contact with ferruginous matter will create considerable changes.

3. Chrystallized Granite. This variety of granite has two of its constituents chrystallized, the quartz and felspar; but we have never observed the mica to assume a chrystallized form. The quartz chrystals are pyramidical as far as we have been able to judge; it is very difficult to separate them from the mass. Lustre, vitreous.—The felspar is chrystallized in rhomboidals, generally of a large size; colour, flesh-red, sometimes reddish white. Fracture, foliated or laminated. Lustre, shining.—The quartz chrystals are generally small. The mica, in small quantites, blackish and shining. It is of rarer occurrence than any of the granite species.

4. PORPHYRITIC GRANITE. The grains of quartz and mica are sometimes so very minute and blended together, that to the naked eye they seem to form one uniform substance; indeed it requires a good lens to distinguish them; when this mixture has large chrystals of felspar imbedded in it, the whole becomes what is termed *Porphyritic Granite.* The felspar is chiefly greyish or reddish white, and presents long prismatic chrystals, frequently twin-chrystals. The quartz and mica form a blackish or greenish mixture. Is not so compact as porphyry, will not take so good a polish, may easily be taken for porphyry.

5. GRAPHIC. This is when the constituents, and particularly the felspar, assume such a form and are so arranged that the surface of the mass has some resemblance to the square characters of the Hebrew. This appearance is chiefly owing to the rhomboidal fragments of the felspar, which are tolerably large; the quartz and mica occur in small grains. The colour of the felspar, which is flesh-red, is deepest on the edges of the fragments, and gradually grows paler toward the centre. Graphic is not uncommon here.

II. Gneiss. *Gneiss*, Wern.—*Id.* Jam. vol. 3, p. 113.—*Id.* Kirw. vol. 1, p. 346.

This aggregate, like granite, is composed of quartz, felspar, and mica; but it is to be observed that these constituents are not granular as in granite, but of a thick, slaty, continuous or fibrous texture. The felspar predominates as in granite; but gneiss contains more mica. The colour of the felspar varies from reddish white to yellowish white; the mica for the most part is black, rarely pearly or shining. The quartz varies from milk-white to greenish white. The mica runs in waved veins; the felspar is flattened and unites intimately with the quartz. Gneiss has been termed slaty granite, but the difference between them is very wide; as gneiss, we before observed, is never granular; also in splitting gneiss in the direction of the strata, the mica will appear in greater quantities than in granite, when broken in any direction. Mr. Jameson enumerates the following kinds of gneiss, all of which the coast produces. 1. That approaching to the granular structure. 2. The waved or undulating. 3. The common. 4. The thin slaty. Decomposition has the same effect upon the constituents of gneiss, as it has upon granite. Takes a tolerable polish. It occurs plentifully; but seldom in such large masses as granite.

III. Grenatine. Of the triple compounds which go under this name, we possess the following. 1. Quartz, felspar, steatites, (or mica, which is nearly in that state.) 2. Quartz, mica, schörl. 3.[*] Quartz, mica, granite. 4. Quartz, felspar, schörl. 5. Quartz, felspar, garnet. 6. Felspar, mica, schörl.

IV. Mica Slate. *Glimmer Schiefer,* Wern — *Schistose Mica,* Kirw. vol. 1, p. 348.—*Mica Slate,* Jam. vol. 3, p. 118.

This stone is composed of quartz and mica, more or less blended together; the structure slaty, straight, or undulating; contains more mica than gneiss does; the quartz is not always apparent. The mica is for the most part grey, or greenish grey. Fracture, perfectly slaty. Lustre, glistening, has a pearly appearance. Heavy. Feels greasy. Sometimes entirely studded over with small chrystals of garnet, accompanied with acicular schörl. Frequently much decomposed. Often discoloured by ferruginous matter which destroys the lustre, and is then a dirty yellow.*

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[*] This aggregate is called Norka, or Mirksten, by Cronsted.

V. GRUNSTEN. The aggregate here is binary, and consists of 1. Quartz, felspar. Quartz, in this case semitransparent; felspar, decomposing of a dull white colour, sometimes yellowish; scarcely shows the granular structure, so that it may easily be taken for petunse-porphyry. 2. Felspar and mica. Felspar, flesh-red, sometimes yellowish; mica in small quantities, in nests and silvery. 3. Adularia † and mica. Mica, black and shining. 4. Quartz and mica. ‡ This is the most common of the binary aggregates. The mica here is disseminated in nests, or insulated patches, silvery and shining, presents also divers colours. This kind of grunsten differs only from mica-slate, in not being stratified. Sometimes the quartz and mica become so small as to approach to sand-stone.* 5. When the mica passes into steatites. 6. Felspar and schörl: here the felspar is traversed by black chrystals of schörl like hairs. Felspar, reddish.

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* When burnt, makes an excellent frosting for ornamental purposes.

† The Adularia which contains much mica, seldom shows the shades of colour.

‡ This is called sometimes Stellstein.

VI. GRANILITE. Aggregates are so denominated when they contain more than three constituents. We have the following kind, viz. Quartz, mica, schörl, garnet.† We might here introduce a second variety, when the mica is in some parts of the mass passing into steatite; but this would be making too nice a distinction.

VII. PORPHYRY. *Porphir,* Wern.—*Porphyre,* Broch. *Porphyry,* Jam. vol. 3, p. 135.—*Id.* Kirw. vol. 1, p. 349.—*Id.* Kidd.

This aggregate we possess in the greatest variety, and it is to be lamented, since it contains so much beauty, that it should be so neglected. Any stone containing scattered chrystals, grains, specks, or spots of felspar imbedded, or cemented, as it were in a silicious, argillaceous, or even muriatic ground, will here be termed a porphyry. It may be either compact or slaty. Mica and quartz as well as iron, may be imbedded in the ground or basis of the porphyry. The base forms the distinguishing characteristic of the different kinds. The imbedded parts, particularly the quartz and felspar, are usually chrystallized more or less perfectly. The quartz is for the most part chrystallized in small double six-sided pyramids. The felspar occurs sometimes in rounded grains, yet it is commonly chrystallized, in rhomboidal, feather-like, or capilliformed chrystals; the two latter are very beautiful. The fragments of the chrystals upon the surface, exhibit generally a rhomboidal aspect. The felspar is usually compact, and then its lustre is shining; upon disintegration, all lustre is destroyed; the appearance is then earthy. Colour, chiefly dead-white, sometimes reddish; not unfrequently derives a tinge from the composition of the basis, particularly so in the green porphyry. It has been observed that the felspar in porphyry differs from common felspar in hardness and fusibility; yet it frequently is decomposed. Porphyry has its name from a greek word, signifying red. The following kinds occurs here.

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* This is denominated Micaceous Grit.

† See Mica-Slate.

Of the Silicious Genus.—1. Jasper Porphyry. 2. Hornstone Porphyry. 3. Petunse Porphyry. 4. Silicious Schistus Porphyry.

Of the Argillaceous Genus.—1. Clay Porphyry. 2. Granitic Porphyry.

Of the Muriatic, or Magnesian Genus.—Green Porphyry.

1. Jasper Porphyry. The basis here is jasper of a dark clouded red colour, sometimes greenish. The felspar occurs almost uniformly in dead-white specks, slightly tending to the rhomboidal form: the quartz also, which is semi-transparent, and probably chrystallized, makes its appearance. The specks of any of the imbedded substances are at best, but thinly disseminated. Particles of iron rarely occur intermixed. The existence of jasper porphyry has been doubted; the basis has been considered hornstone; the porphyry above described has not any of the characters of hornstone. We have seen some specimens of the striped jasper on the coast, containing specks and rhomboidal fragments. Sometimes takes a good polish.

2. Hornstone Porphyry. Colour, blackish, greenish, or yellowish brown, mostly clouded or streaked. Felspar in rounded grains, or in elegant feathered or

rhomboidal chrystals, chiefly of a reddish white colour, rarely brick-red. The ſelspar, though it retains its hardness, yet is evidently decomposing, ſrom its red colour. The hornstone as well as the ſelspar is liable to decomposition, and when this is the case, the stone assumes a pseudo-volcanic appearance. Hornstone-porphyry, is to be distinguished by its slight transparency, conchoidal fracture, and want of lustre. The fragments are commonly rolled, sometimes they have a rhomboidal tendency. See Hornstone.

3. PETUNSE PORPHYRY. *Silex Petunse Kaolin*, Sowerby's Brit. Min. vol. 3, tab. 224.

This species of porphyry has felspar for its basis, containing semi-transparent chrystals of quartz of the double six-sided pyramid. Colour of the base, whitish red, greyish white, and yellowish white. Contains a small portion of mica in minute specks and blackish. The felspar composing the base, on close examination will often appear slightly tending to the granular structure. The fracture is earthy. Opaque. Not particularly heavy. Frequently occurs. The effects of disintegration are very visible.

4. Silicious Schistus Porphyry. Colour, blackish brown. Felspar, in small oblong fragments, generally whitish, and when decomposed ochrous yellow. In other respects this porphyry answers to the characters of silicious schistus, or flint-slate, which see.

5. Clay Porphyry. Colour, generally brown, or some shade of it; as blackish brown, greyish brown, or reddish brown; sometimes many of these occur together, forming flamed, or clouded delineations. It here invariably contains iron, in small specks, which takes a good polish; it is plombaginous. The fragments of the felspar in this beautiful species, have a peculiar form, being usually in very acute angled rhombuses; sometimes it exhibits feathered chrystals. Colour, varying from greyish to greenish white. The felspar is frequently sprinkled with very minute spots of iron, which on a cursory view, might be taken for particles of sand. This kind of porphyry seldom contains quartz or mica; it is said that hornblende enters into the composition; but of this we are ignorant. When free from disintegration, takes a good polish, has no lustre or translucency. Fracture, earthy, sometimes very hard.

6. Sandstone Porphyry. Colour, reddish, sometimes yellowish grey. The basis is here a sand-stone, containing specks, and sometimes large grains of felspar and quartz. Felspar often shows twin-chrystals, the lustre of which is shining. Soft; easily frangible, sometimes crumbly. The colour of this porphyry apparently derives its tinge from iron.

7. Granitic Porphyry. When porphyry is overloaded with felspar, as Mr. Kirwan observes, it is often difficult to say, whether it be a granite or a porphyry, which hath a granitell for its basis. As this species is so very doubtful, great care must be taken not to confound it with granite. We certainly do possess a stone of the description mentioned by Mr. Kirwan; but it is not common, and is always decomposed in a great measure.

8. Green Porphyry. Its basis is said to be granular; but we have not been able to detect that construction even by a good lens. Colour, blackish green: we are inclined to think that chlorite enters into the composition; it has been asserted that hornblende does. The felspar derives a strong greenish tinge from the base; sometimes tinged

only on the edges; the centre being whitish. Occurs in featherlike, capilli formed, oblong, or twin-chrystals, often cleft in twain like the letter Y. Greatly resembles *verde-antique* porphyry. Takes a good polish; is of rare occurrence.

The varieties of the porphyries of the coast defy description: we have seen no less than fifty specimens of the clay-porphyry, each possessing a remarkable difference. The sand-stone, silicious schistus, petunse, and hornstone porphyries, possess almost an infinite variety. We trust, however, that the general outline which has been given, will answer all purposes, as the variety consists in the modifications of the felspar, quartz, &c. and not in the basis which characterizes the porphyry.

VIII. AMYGDALOID. *Mandelstein*, Wern.—*Id.* Kirw. vol. 1, p. 358.—*Id.* Jam. vol. 3, pp. 149, 177, 194.—*Id.* Kidd, vol. 1, p. 248, & p. 19. of app. vol. 2.

Any argillaceous stone, which in a ground or basis, contains elliptical, or rounded masses of chalcedony, carnelian, agate, calcareous spar, and quartz, is called Amygdaloid. The colour of the basis is lightish brown, greenish, or reddish, generally composed of indurated clay. Has neither transparency nor lustre. The calcareous nodules are generally fresh; texture laminated, and the lustre shining; colour, sometimes reddish or greenish. The imbedded nodules will sometimes fall out, and then the stone presents the vesicular structure of lava. The most compact varieties will not take even a tolerable polish. Occurs here in great abundance. It has its name from the latin word *'amygdala,'* which signifies an almond, the imbedded nodules assuming that appearance. In Derbyshire it is called *toad-stone, or cat-dirt.*

IX. PUDDING-STONE. *Poudinge,* Broch.—*Poudding Anglais,* Haüy.—*Pebble-stone,* Kidd, app. vol. 2, p. 21.—*Pudding-stone,* Kirw. vol. 1, p. 360.

A collection of small elliptical, and rather flattened pebbles, consisting of quartz, flint, or jasper, imbedded in a silicious ground, is termed a pudding-stone. The pebbles in the best varieties, are flints, of various colours, as yellow, red, black, whitish, and bluish; and these admit of different arrangement in the same pebble, as in clouds, streaks, and concentric rings. The colour of the cement or basis is whitish, or yellowish grey, sometimes reddish and blackish brown; and is generally so indurated, that in breaking the mass, the imbedded flints also, partake of the fracture; in the less indurated, and even in the indurated varieties, the pebbles come out whole. The pebbles are some of them slightly translucent on the edges; rarely hollow, or containing quartz-chrystals. Susceptible of a good polish; it is found in rolled pieces; rarely occurs here. Exactly agrees with the celebrated Berkshire pudding-stone. The coarser varieties we possess in great abundance; these do not contain rounded pebbles only, but angular pieces of the different species we have mentioned, as the constituents of pudding-stone, cemented chiefly in a quartzose basis. These aggregated pieces are sometimes of the same hardness, and the mass is tolerably compact, taking a polish; but for the most part the hardness is of different degrees. The colour of the pieces is various. Mr. Sowerby has beautifully figured the variety just described, in his British Mineralogy, vol. 1, tab. 92, lower figure. The ferruginous, or iron based pudding-stones are also very common; but the iron so corrodes and discolours them, that they possess but little beauty.

We have deemed it unnecessary to say much respecting sand-stones, as their varieties possess but little interest; it may be sufficient to observe, that they contain minute grains of quartz, flint, hornstone, felspar, mica, &c. imbedded in an argillaceous, or silicious ground. The ferruginous sand-stone occurs in a stratum, laying immediately under the slaty cliff, near the Spaw, which is sometimes exposed by the washing away of the sand which generally covers it. A silicious granular mass, not unlike French-grit which is used for mill-stones, will frequently be discovered in small pieces on the coast.

## XLIV. PETROLEUM.

*Erdol,* Wern.—*La Naphta, L'Huile minerale commune, ou le Petrol,* Broch. vol. 2, p. 59.—*Bitume liquide,* Haüy, vol. 3, p. 312.—*Naphtha, or Petrol,* Kirw. vol. 2, p. 42.—*Petroleum,* Kidd, vol. 2, p. 62.—*Id.* Parkinson, organic remains, vol. 1, p. 131.—Fossil or Mineral Oil, Jam. vol. 2, p. 44.

Colour, reddish brown, passing into black. It is a fluid, more or less viscid, accordingly as it has been exposed to the air. Translucent. Feels greasy. Smell bituminous, not unlike a sweet pastile. The opportunites we have had of seeing the petroleum of the coast have been very few; it is extremely rare. A few drops which we obtained on breaking a mass of ammonites, were preserved in a piece of folded paper, burnt readily with a bluish flame. Occurs almost universally in masses of the cornu-ammonis, contained between the septa. We have been informed that it is to be met with on the Whitby coast in tolerable plenty; but of this we have no certainty.

## XLV. BITUMINOUS WOOD OF THE COMPACT KIND.

*Bituminoses Holz,* Wern.—*Bituminous Wood,* Jam. vol. 2, p. 54.—*Bovey Coal,* Kirw. vol. 2, p. 61.

Colour, light or dark brown, approaching to blackish brown. Its organic structure is sometimes evident externally, exhibiting branches, knots, &c. internally, and ever shows the texture of wood, generally much compressed. When broken in the direction of the grain, it has a fibrous appearance; in the cross direction, the fracture is imperfectly conchoidal; the former presenting a dull glimmering, the latter shining, and somewhat resinous. Yields to the nail. Generally contains pyrites, and is incrusted with it; burns with a weak bluish flame, emitting during combustion, an offensive smell. Very light, but never here buoyant Occurs in tolerably large masses, imbedded in a soft crumbly sand-stone, which will be seen on the north shore, extending nearly from the Castle-foot to Scalby-beck.

## XLVI. BITUMINOUS WOOD OF A SCALY EARTHY TEXTURE.

Colour, nearly the same as the foregoing, but somewhat lighter, rarely blackish brown. Very much flattened, seldom exhibiting branches or knots externally. Traversed in all directions by veins of a soft waxy calcareous spar. Soft. Easily frangible. Great fracture, slaty and glimmering; cross fracture, hackly and uneven; glistening, rarely resinous. Burns feebly, and leaves a large earthy residuum. Yields an unpleasant odour during burning. Much heavier than the former kind. Yields to the knife. Occurs for the most part adhering to an indurated aluminous rock of a bluish colour, in compressed masses, seldom of any thickness, chiefly at Whitby and Stow-brow. Has been found sometimes, a little to the south of the Spaw, at Scarborough, on some rocks which are commonly covered with sand.

## XLVII. MINERAL CHARCOAL.

*Mineralische Holzkohle,* Wern.

Colour, raven-black, approaching to greyish black. Occurs in angular, cubical, and flattened masses, also in thin laminæ. Has a glistening, and sometimes a silky lustre. Almost universally shewing the ligneous texture. Fracture, fibrous. Soils much after the same manner as common charcoal.* Light, nearly buoyant. Rarely pure, but traversed or incrusted with pyrites. Takes fire, and retains it nearly the same as charcoal, emitting at the same time a strong sulphureous smell. Occurs in a yellow sand-stone, to the north of Scarborough, sometimes at a considerable depth; a single cubical mass, and very pure, was found imbedded in the free-stone rock at Cloughton-Wyke; the incumbent mass of stone must at some period have been nearly forty feet.

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* See, "An Attempt towards a Natural History of the Fossils of England, in a Catalogue of the Fossils in the collection of J. Woodward, M. D. part II, p. 19.

## XLVIII. JET.

*Pechkohle,* Wern.—*Jayet,* Haüy.—*Pitch-Coal,* Jam. vol. 2, p. 64.—*Bitumen-Gagas of Linnœus.*

Colour, pure black. Occurs in detached masses, sometimes in plates* which have a slight tendency to stratification; the thickness of these is various, in some cases exceeding four inches, whilst in others it is scarcely half an inch.† Fracture, perfectly conchoidal. Lustre, shining and somewhat resinous. Has a smooth feel. The exterior is striated like wood with its bark stripped off. Rather hard. Emits a disagreeable smell when applied to a candle; flame, rather greenish in the fire. Light. Becomes electric by friction, and attracts light bodies. Susceptible of a very high polish. At Whitby, and its neighbourhood, it has been discovered in very great plenty in the alum works. It is to be found at Scarborough, Bridlington, and other places, chiefly in small fragments, and sticking in the crevices of the rocks, or on the sands; these in all probability have been brought by the sea from some other place. Jet frequently contains pyrites, either incrusting it, or intermixed in small grains, sometimes it has a veinous tendency. The exterior surface rarely exhibits impressions of shells, &c. It is worked up to form various trinkets, as seals, beads, snuff-boxes, &c.*

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* This is called by the Jet-turners, plank-jet.

† The masses of jet are frequently of a curious form, being thick in the middle, and gradually tapering all round, till at the edges they are comparatively very thin. Masses of this

The foregoing description is applicable only to what is termed here pure jet, in which no internal evidence is visible of the ligneous origin: it will frequently happen that many masses of jet bear not only external proofs of the origin we have men-

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description occur at Whitby and its neighbourhood, insulated in the aluminous rock; indeed this peculiar formation would lead us to imagine, that the mass being formerly in a state of fluidity, had been thrown as it were from a vessel on the scar, and there instantly congealed; the under surface of the jet being in some instances marked or indented by the inequalities of the rock, would seem to support this opinion.

* Several jet-turners have Shops at Scarborough, Whitby, Bridlington, &c.

tioned, but on polishing their surfaces exhibit the grain of wood in a very perfect degree: this we denominate *jet-wood;* in its characters it will be found to agree precisely with pure jet, if we except the colour, which is seldom so deep.

## XLIX. AMBER.

*Bernstein,* Wern.—*Succin,* Haüy.—*Amber,* Kirw. vol. 2, p. 65.—*Id.* Jam. vol. 2, pp. 91, 92.—*Id.* Kidd, vol. 2, p. 36.—Sir J. Hill on Fossils, p. 410.—Sowerby's Brit. Min. vol. 3, p. 147.—Parkinson's Organic Remains, vol. 1, p. 153.

Its most common colour is yellow, which sometimes, but rarely passes into orange; the yellow is wax, honey, and whitish yellow. These shades will in many instances be found in clouds or streaks in the same specimen, and when this is the case the amber is but translucent; when one shade only occurs it is semi-transparent, and sometimes even transparent. Externally, its lustre is glistening; internally, it is shining, between vitreous and resinous. Fracture, perfectly conchoidal. Fragments, sharp edged. When heated, emits a fragrant odour, which is the case also when it is pounded. Burns with a yellowish flame, slightly intumescing, but not melting. Occurs in rolled and somewhat angular pieces. Yields easily to the knife; becomes electric by friction, or heat; this property was known to the ancients (as is observed by Prof. Jameson) who termed amber, *electrum*, whence is derived our word electricity. Dr. Woodward informs us that amber was found in the clayey or aluminous rock, and on the shore at Whitby in three states, as rock, washed, and fat-amber; this is seldom the case at present. Sir J. Hill also relates that he has picked up amber on the Yorkshire-shores. Amber is very rare at Scarborough, and its adjacent shores; at Bridlington, Fraisthorp, Barmston, Hornsea, and other places on the Holderness-coast, it is to be met with in considerable quantities, some of the specimens weighing from one to two ounces. It is commonly found on the beach, at high-water mark; some specimens have been taken up on the ploughed lands near Barmston; but these have doubtless been carried together with the sea-weed, which is much used there for manure.

## L. COMMON PYRITES.

*Gemeiner schwefelkies,* Wern.——*Fer sulfure,* Haüy.—*Common Iron-Pyrites,* Jam. vol. 2, p. 253. *La Pyrite martiale commune,* Broch. vol. 2, p. 221. *Common Sulphur-Pyrites,* Kirw. vol. 2, p. 76.

Colour, pale or brass-yellow, nearly bronze-yellow, seldom much tarnished. Occurs chrystallized, investing, and disseminated, also globular, mamillated, &c.

The chrystals are.—1. The cube, the planes generally convex, rarely straight.* 2. The cube having all its angles cut off or truncated.† 3. The octohedron with all its angles truncated. Of these the cube is here the rarest, and seldom occurs single, but in chrystals variously heaped together, as in the specimens from Rillington and Wharham-Piercy in the neighbourhood of Malton; these masses assume a botryoidal form; the two latter chrystals occur single, as at Speeton in the cliffs

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[*] Sowerby's Brit. Min. vol. 1, tab. 29.

[†] Sowerby's Brit. Min. vol. 1, tab. 99, left hand figure at the bottom of the plate.

there, also aggregated as in the Malton specimens. The surface of the chrystals is rarely smooth, but is beset with miscroscopic chrystals, which give the planes a drusy appearance. The external lustre is generally shining; the Speeton chrystals are dullish, and this we attribute to the sea-air. Internally it has a shining metallic lustre. At Scarborough we find it in the argillaceous Iron-stone, sometimes investing,* sometimes disseminated. Fracture, coarse or granular-uneven. Heavy. When rubbed or pulverized emits a strong sulphureous odour, which is the case also when it is heated. Some specimens have been said to be magnetic, but these we have never seen. Hard; brittle. In addition to the abovementioned localities, we find common pyrites at Whitby and its neighbourhood, Stowbrow, Bridlington, and Flamborough.

## LI. RADIATED PYRITES.

*Strahlkies*, Wern.—*Striated Pyrites*, Kirw. vol. 2, p. 78.—*Radiated Pyrites*, Jam. vol. 2, p. 257.—*Fer sulphure radie*, Haüy.

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* The extraneous-fossils of the coast are some of them

Colour, a dull bronze yellow; internally it is the same as the foregoing species, but tarnishes on exposure to the atmosphere, and becomes pavonine. Occurs globular, botryoidal, in heaped and imperfect chrystals, which have their form from the truncations of the octohedron, also in thin curved lamellar masses. The distinguishing character is its radiating structure, the radii proceeding from a point nearly in the centre of the nodules, &c. Occurs chiefly at Speeton, sometimes at Scarborough. The remaining characters agree with the foregoing nearly, if we except the fracture which is divergingly striated.

## LII. CAPILLARY, OR HAIR-PYRITES.

*Haarkies,* Wern.—*Fer sulphure capillaire,* Haüy. *Capillary Pyrites,* Kirw. vol. 2, p. 79.—*Id.* Jam. vol. 2, p. 263.—*Silky filamentous Sulphate of Iron,* Sowerby's Brit. Min. vol. 1, tab. 28.

Colour, steel-grey or darkish yellow. Occurs in acicular chrystals variously aggregated as at

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bronzed as it were with this species; sometimes they are entirely composed of it.

Stowbrow and Kettleness. Slightly flexible. It is very rare. The specimen figured by Sowerby was obtained from Stowbrow.

## LIII. HEPATIC, OR LIVER PYRITES.

*Leberkies,* Wern.——*Fer sulphure decompose,* Haüy.—*Hepatic Pyrites,* Kirw. vol. 2, p. 83.—*Id.* Jam. vol. 2, p. 261.

Colour externally, brown, sometimes yellowish, or even blackish brown; internally it is pale brass-yellow inclining to steel-grey. Occurs in pseudo-chrystalline forms, also disseminated, botryoidal, globular, &c. Fracture, generally even, passing sometimes into flat-conchoidal. Liable to decomposition; agrees with common pyrites in its localities, and remaining characters.*

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* The foregoing descriptions of the several species of Pyrites, pertain only to those which exist in a state of purity, unmixed in great measure with argill; in general however, the pyrites of the coast is intimately united with argillaceous earth, forming in that case an alum-ore, in this state it is extremely liable to decomposition: externally it is greenish, arising from the conjoint action of the sea-water, and the atmosphere; often crusted with an efflorescent white powder, which has a sweet

## LIV. PYRITOUS WOOD.

*Pyritous Wood,* Parkinson's Organic Remains, vol. 1, p. 290, lett. 28.

Colour, pale or brass-yellow, sometimes inclining to steel-grey. Occurs in long and small knotted, and knobbed pieces, bearing externally and internally the ligneous texture. In a state of decomposition it obtains a greenish colour, generally blackish green. Fracture, uneven, sometimes tending to the conchoidal, and particularly so when argill enters into the composition. Lustre, metallic. Hard; brittle; heavy. When thrown into the fire emits a suffocating sulphureous smell. Gives a black streak. It is soluble like common pyrites in nitrous acid, leaving a brownish black bituminous residuum; sometimes even the fibres of the

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astringent taste. The nodules of alum-stone assume various fanciful forms, as double-headed shot, spheres, lemons, pears, &c. these are universally coated with pyrites in a state of combination with argill; a forcible blow will separate this pyritous crust from the geod in hollow cup-like pieces, exhibiting on the edges the appearance of bell-metal. The alum-stone of the district is composed of petroleum, pyrites, wood composed of this, are left in a pretty perfect state; and when properly dried will readily ignite. Occurs chiefly at Whitby, and on the north-sands at Scarborough, imbedded in a dark blue loamy clay; at Bridlington in a bed of similar description toward the low-water mark. The pyritous masses of Speeton, at first sight, have much the appearance of

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and argill; on bisecting many of those curiously formed masses above-mentioned, and polishing the sections, we are enabled in some measure to account for their formation; it appears that they contain within them numerous extraneous fossils or fragments of them, as the cornu-ammonis, nautilites, belemnites, fossil-bones, &c.; round these remains will be seen concentric layers partaking of the inequalities of the surface of the inclosed body; the first layer is ever the blackest, and contains the most bitumen; the succeeding ones gradually become lighter, and the outer one exhibits a coat of pyrites, tolerably pure, of a bronze-yellow colour; surmounting this, and on opposite sides of the geod, will be seen a crest of microscopic pyritous chrystals. It would seem then, that water in percolating through aluminous strata, containing extraneous fossils, had at first deposited upon these bodies a mixture of petroleum, pyrites, and argill; the petroleum and argill in the greatest quantities, the pyrites in the least; that in the succeeding depositions, the pyrites gradually gained the ascendancy, till at length we see it shooting out into chrystals. Geods of the above description occur in abundance in the alum-works, and in the slaty cliff near the Spaw at Scarborough.

wood; but on inspection they will be found to be formed by successive depositions. What we have here termed pyritous wood is the ligneous alum-ore of Kirwan, see vol. 2, p. 20.

## LV. MAGNETIC IRON SAND.

*Eisensand*, Wern.—*Magnetic Sand*, Kirw. vol. 2, p. 161.—*Le fer magnetique sablonneux*, Broch. vol. 2, p. 241 —*Iron Sand*, Jam. vol. 2, p. 274.

Colour, in the gross greyish black, from the mixture of adventitious particles, chiefly siliceous, when pure or extracted from these particles, it is of a deep iron black, and has much the appearance of fine gun-powder. Occurs in small roundish or angular grains, never chrystallized. Lustre of that obtained from the stratum, dull, of that from the beach, shining and metallic. Heavy. Strongly metallic; easily collected by passing a magnet gently over the surface of the sand, or slightly plunging it in; the particles clinging to it after the manner of steel-filings.* It is found in the greatest quantities on the north-sands near Peasholm-beck; this rill of water cuts in two a stratum of red clay, which contains the sand in thin veins; in its course it carries the sand down with it, and deposits it on the beach, whence it is drifted by the wind on both sides the channel.

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* Sowerby's Brit. Min. vol. 2, tab. 197.

## LVI. PLOMBAGINOUS IRON-ORE, OR IRON-GLANCE.

*Eisenglanz,* Wern.—*Fer oligiste,* Haüy, vol. 4, p. 38.—*Le fer speculaire commun,* Broch. vol. 2, p. 242.—*Iron-glance,* Jam. vol. 2, p. 276.

Colour, deep steel-grey. Occurs always disseminated, as in jasper and quartz; in the former it has rather a veinous tendency, in the latter it is in rounded blotches; it occurs also in agate; specimens of this description are very beautiful. Lustre, varying from glistening to shining, and highly metallic, has very much the appearance of graphite or black-lead. Fracture, granular uneven. Opaque; gives a cherry-red streak. Heavy; brittle.

## LVII. COMPACT RED IRONSTONE.

*Ditcher Rotheisenstein,* Wern.—*Compact Red Ironstone,* Jam. vol. 2, p. 289 —*Id.* Kirw. vol. 2, p. 170.

Colour, intermediate between dark steel-grey and brownish red. Occurs in rolled and blunted angular pieces, the exterior surface of which is sometimes cellular, pitted, and rough. Fracture, passing from uneven to conchoidal. Internally the lustre is glimmering, and slightly semi-metallic. Fragments, sharp-edged. Hard; heavy; brittle. Gives a blood-red streak, and on this account it is called bloodstone here. Takes a tolerable polish. It is not uncommon.

## LVIII. JASPERY CLAY IRONSTONE.

*Jaspisartiger Thoneisenstein*, Wern.——*Jaspery Clay Ironstone*, Jam. vol. 2, p. 325.

Colour, brownish red. Occurs in blunted, angular, and rolled pieces. Fracture, flat-conchoidal. Lustre glimmering. Streak, reddish. Heavy; bears a great resemblance to jasper.

## LIX. COMMON CLAY IRONSTONE.

*Gemeiner Thoneisenetein*, Wern.—*Common Argillaceous Iron-ore*, Kirw. vol. 2, p. 173.

Colour, steel, ash, yellowish, bluish, blackish, or reddish grey; on exposure to the air it becomes yellowish or dark nut or clove brown, or dark brick-red. Occurs in stratified masses of considerable extent* in the neighbourhood of Scarborough, in nodular, and large rounded pieces; it forms also various extraneous fossils, as shells, &c. Fracture, earthy, flat-conchoidal, uneven, and splintery. Without lustre. Passing from very soft to hard. Heavy.†

## LX. KIDNEY, OR RENIFORM IRONSTONE.

*Eisenniere*, Wern.—*Nodular Ironstone*, Kirw. vol. 2, p. 178.—*Fer Oxyde rubigineux geodique*, Haüy, vol. 4, p. 107.—*Reniform Iron-Ore, or Iron-Kidney*, Jam. vol. 2, p. 329.

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* A few years ago it was carried to Newcastle and smelted by Messrs. Fishwick & Co.

† This species is frequently traversed by calcareous spar, which divides it into squares and other polygonal figures, giving it the appearance of the Ludus Helmontii; these are much admired, and take a tolerable polish. Mr. Sowerby observes, "It appears that the Iron-clay in lumps has cracked internally, and that calcareous earth has chrystallized in the interstices." Brit. Min. vol. 1, tab. 61. upper and lower figures.

Colour, yellowish brown, sometimes blackish brown, internally it is lighter, approaching to ochrous yellow. Occurs in nodular, kidney-formed, quadrangular, and triangular pieces. It is composed of curved lamellar concretions, formed by water passing through argillaceous strata, impregnated with the oxide of Iron. Many of these masses are hollow, and sometimes contain within a loose kernel; it is then denominated ætites; some have the shape of boxes.* Easily frangible; not particularly heavy. Dull. Some specimens give an idea of the formation of Ægyptian Jasper, as is observed by Mr. Sowerby. It occurs in the cliff to the south of the spaw, and in that on this side of Scalby-beck, &c.

## LXI. GRANULAR IRONSTONE.

*Bohnerz.* Wern.—*Fer oxyde rubigineux globuliforme,* Haüy.—*Pisiform, or granular Ironstone,* Kirw. vol. 2, p. 178.

Colour, yellowish, or reddish brown. It is composed of an aggregated mass of small rough grains, slightly rounded. Fracture, earthy. Lustre, dull, sometimes, but rarely, glimmering. Heavy. Soft. Subject to decomposition. It is common here.

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* Sowerby's Brit. Min. tab. 107.

### LXII. IRON-WOOD.

*Iron-wood,* Parkinson's Organ. Rem. vol. 1, lett. 41, p. 393.

Colour, brown and red; of brown, darkish or blackish brown, sometimes clove brown. Of red, brick-red, yellowish red, and dark brownish red. Internally it is steel-grey of various shades, sometimes reddish. Occurs in branched, knotted, and amorphous masses, exhibiting externally the fibres and knots of wood. The exterior surface is rough and uneven, much pitted and very porous. The pores are frequently incrusted with splendent minute quartz chrystals. Cross fracture, even, splintery, or flat-conchoidal; the great fracture is straight and fibrous. Internally, the ligneous texture is rarely to be seen. Lustre internally, passing from glimmering to semi-metallic. Very hard; heavy; brittle. Takes a bad polish. Occurs chiefly at Whitby, and Sands-end. The Iron-Wood of Scarborough approaches nearer to what we shall term argillaceous wood. It is wood highly impregnated with ferruginous matter.

The effects of the rust of iron are very surprising here; we have seen a tolerable grit-stone formed by a single nail; horse-shoes, scissars, &c. have been discovered in the centre of large ferruginous masses; when wood is thus inclosed, it becomes in great measure changed to a kind of Iron-wood. The effects of this impregnation will readily be seen, on examining the timbers of the pier and spaw, in the places where nails and bolts have been driven, the wood all around obtaining a stony hardness. Mr. Parkinson* states of Doctor Fothergill, that "Part of a horse-shoe was seen by the Doctor on the sea-coast near Scarborough, incrusted with sea-sand; and although the sand was but little tinctured with an ochry colour from the Iron, it had acquired the hardness of common grit stone."

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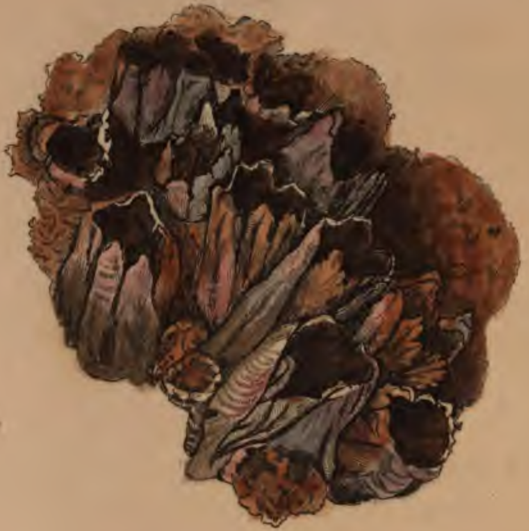
* Organic Remains, vol. 1, p. 408.

# Part Second.

# FOSSIL CONCHOLOGY.

*Plate I.*

1



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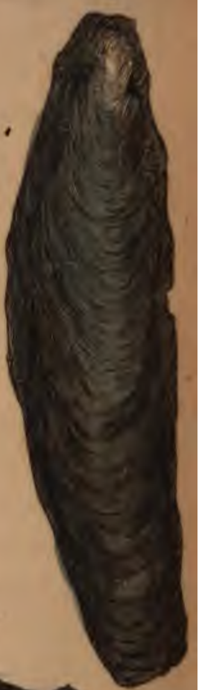

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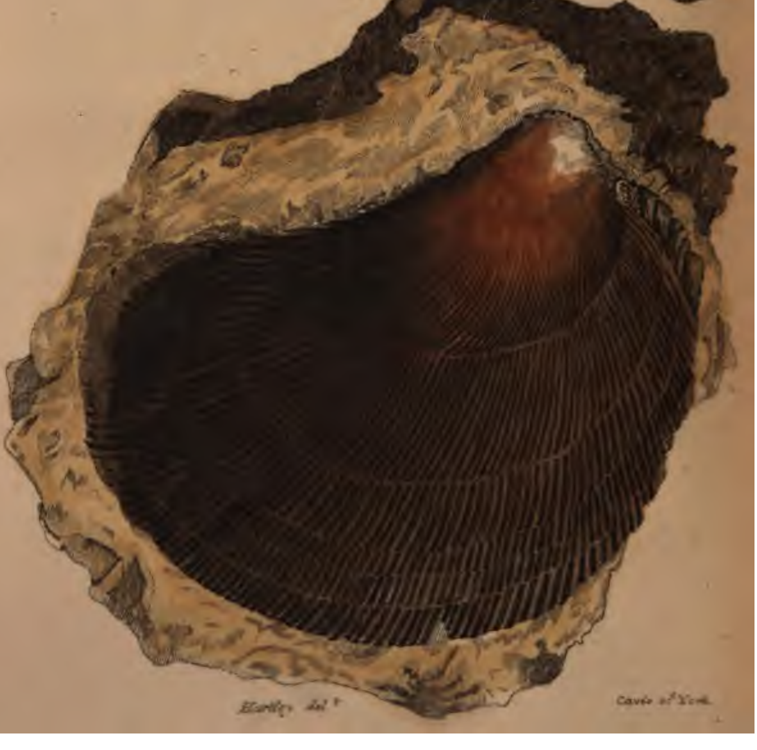

Hartley delt

Cave sct York

# FOSSIL CONCHOLOGY.

I. *LEPAS.*[*] *Barnacle.—A multivalve, valves unequal; fixed by its base.*

Rarely occurs in a fossil state. Of the species figured, plate 1, fig. 1, nineteen in number, were found adhering to a fragment of a pectenite, imbedded in the yellow sandstone rock of the castle, a little to the north of the pier. The valves six, rugged, and slightly striated in a direction perpendicular to the base—shell, large and deep—has rather a conical aspect—retains the recent purple tinge,—little changed from a recent state. Resembles the *Lepas Tintinnabula*,* or *Bell Lepas* of Linn.

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[*] Linnæi Syst. nat. p. 1107.—No. 301.

A minute fossil *Lepas* has been said to have been discovered adhering to the fossil shells of Filey-bridge; but it has never come under our examination.

II. *MYA.*† *Gaper.——A transverse bivalve gaping at one end. (The hinge, for the most part, furnished with a thick, strong, and broad tooth, not inserted into the opposite valve.)*

A fossil shell, bearing the characters of the *Mya Pictorum*, has been met with in the neighbourhood of Malton; also fragments of a similar fossil occur imbedded in the ferruginous rocks of the north-sands.

The *M. Dubia* of Pennant‡ has been discovered in the freestone quarries of Cloughton. It is a small shell, with a large hiatus opposite the hinge.

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* Syst. nat. p. 1108.—No. 12.

† Lin. Syst. nat. p. 1112, No. 303.—Pennant's British Zoology, vol. 4, p. 78.—Parkinson's Organ. Rem. vol. 3, p. 193.

‡ Brit. Zool. vol. 4, tab. 41.

III. *SOLEN.*[*] *Razor.—A very broad and extremely short equivalved bivalve; open at both ends; (the hinge teeth at one extremity.)*

*Solen Siliqua*, or *Pod-Solen.*—Occurs mineralized in the limestone-rock of Pickering: it is a straight shell, from five to six inches broad, sometimes more, and from an inch to an inch and a half long. The exterior is nearly smooth; slightly undulated longitudinally with faint semilunar ridges. The fossil shells of this species agree with the recent analogue,[†] except that the valves are much thicker, and are composed of chrystallized carbonate of lime.

*S. Ensis*, or *Scymeter Solen.*—Abounds in the loose indurated iron-clay at the Nab, composed of a brown spathose matter, and so extremely fragile, that it requires the greatest care to obtain an entire specimen. It is a curved shell—valves, broadest in the middle, and gradually tapering toward each end. The exterior of this solenite is marked much after the same manner as the preceeding; but the valves are much thinner. See plate I. fig. 2. It is also figured by Pennant, tab. XIV. fig. 22, and by Lister in his Conchology, tab. CCCCXI.

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[*] Lin. Syst. nat. 1113.—Park. Organ. Rem. vol. 3, p. 192.

[†] The recent shell is very common at Filey, and other places on the coast.

Fragments of shells bearing some resemblance to the *S. Vagina,* and *S. Strigilatus* of Linnæus, occur in the rocks of the north-sands, and at Stowbrow; but it is impossible from their mutilated state, to speak of them with any certainty.

IV. *TELLINA.**—*An ovate bivalve generally sloping down, more or less on one side. (Three teeth at the hinge.)*

We have, at the expense of many specimens, in vain endeavoured to discover the hinge teeth; the species introduced here, however, coincide in their characters with the genus *Tellina* rather than any other; besides, as Mr. Parkinson observes, "the shells of this genus are chiefly known by the inflection, or irregular fold on their fore part." The following species may be referred to this genus.

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* Lin. Syst. nat. 1116.—Parkinson's Organ. Rem. vol. 3, p. 192.

1. A small ovate shell composed of a thin nacrous crust, slightly truncated on the narrower end, and rounded on the broader—valves concentrically striated. Agrees with the *Tellina fragilis* of Linnæus. Occurs in the rocks on the north-sands, in single valves.

2. A large thick ovate shell a little depressed—valves with numerous concentric distinct striæ—length, two inches and a half; breadth, three inches; composed of a pellucid yellowish carbonate of lime. From the Malton and Seamer quarries. Approximates to the *T. Crassa* of Pennant, tab. XLVIII, fig. 28.

3. A large shell much more truncated than the former—considerably depressed—the concentric striæ of the valves, longitudinally crossed by faint oblique waved ones. Occurs on Langton-Wold, and at Settrington near Malton. Composed of spathose matter.

4. A small convex rostrated shell—valves slightly striated in the direction of the breadth. Figured by Parkinson, pl. XIII, fig 4, vol. 3, and placed by him under this genus. This fossil is very common in the aluminous shale, in the neighbourhood of

Whitby. Composed of a blackish brown spathose matter.

V. *CARDIUM.** *Cockle.—A bivalve, with equal and nearly equilateral suborbicular valves, generally very convex and longitudinally ribbed, sulcated or striated. Margin, dentate. (Two hinge teeth and one lateral tooth in each valve.)*

1. *Cardium,* of an oval form, slightly depressed, with faint longitudinal ridges and some transversal ones. Occurs at Malton, composed of the carbonate of lime, imbedded in roe-stone. Much resembling the *C. Lævigatum* of Linnæus. Varies from five to seven inches in circumference.

2. *Cardium Edule. Edible cockle,* occurs also at Malton; good specimens are rare, casts are common.

A very rough and highly nacrous fossil shell of this species is sometimes discovered in the Ironstone of the coast—with prominent beaks—the valves with deep ridges—convex—margin much serrated—nearly of the size of a walnut. Several highly interesting specimens of this species, have been found on the beach here, and at Bridlington, composed of a translucent yellow chalcedony.

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* Lin. Syst. nat. 1121.

3. *Cardium Cordiforme. Heart cockle.*—A large convex shell, with prominent beaks, turning inward; one side rostrated; the valves marked by elevated diverging ridges, few in number; the intervening sulci, broad and rounded, and transversely striated by numerous slightly rugose-waved concentric striæ. Nearly as large as a fist. The convexity of the valves, and the prominency of the beaks, give the fossil the figure of a human heart, as it is commonly depicted. Occurs in the pyritaceous rocks on the north-sands, composed of a brownish, or blackish spathose substance; also at Malton, and in the quarries of Appleton and Barton in that neighbourhood.

4. A small depressed thin shell with frequent longitudinal minute ridges, occurs in the alum-shale of Stowbrow, agreeing in some respects with the *C. Ciliare*, or *Fringed Cockle* of Linnæus. Composed of a nearly friable white nacrous matter.

5. The shell figured by Parkinson, vol 3, pl. XIII, fig. 3, as resembling the *C. Æolicum* of Linn., will be met with in the limestone quarries of Seamer. The fore-part has a slight depression like the *Tellinite,* and is longitudinally ridged—the posterior part is transversally striated.

VI. *DONAX.*[*]*—An equivalved and inequilateral bivalve, the frontal margin very blunt. (The hinge teeth, two, either in one or both valves; the lateral teeth one or two rather distinct.)*

The fossil shell figured by Parkinson, pl. XIII, fig. 7, and placed by him under this genus, is very common here. The valves are extremely thick, often much compressed and marked transversely by a few deep indented lines, formed by the successive laminæ composing the fossil. It will be found disengaged from its matrix, which is here invariably aluminous, in the gravel-heaps on the shore.

The fossil figured pl. XIII, fig. 6, by the same author, has also been placed by him under this genus, who at the same time observes—[†]"I have introduced it in this place, not knowing one more appropriate, and trusting that its form may excuse a temporary disposal of it here, until a more satisfactory examination may detect its several characters, which I think will be found different from those of any known shell." The fore part is extremely blunt—the valves are elegantly marked by numerous small waved striæ, traversed by a few transversal ones—the posterior side near the beak, projects out into a sort of eared process. It is very remarkable that the valves are generally coloured with a beautiful deep-red, and notwithstanding the perfect state of mineralization, in which they have ever been discovered, they appear to differ little externally from a recent shell.* The size of these fossils varies from three to seven inches in length, and nearly the same in breadth. The valves rarely occur united, but generally single and detached. Hitherto they have occurred only in the neighbourhood of Malton. See an elegant specimen of this fossil, pl. II, fig. 1.

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[*] Lin. Syst. nat. 1126.

[†] Organ. Rem. vol. 3, p. 182.

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* The above description refers chiefly to the smaller kinds; in the larger fossils, the striæ are much larger, approximating to ribs.

VII. *VENUS.*[*]—*An equivalved, inequilateral bivalve, often ovate, or orbicular (hinge with three approximate diverging teeth in each valve.)*

Casts of shells occur at Stowbrow, Kettleness, and on the north-shore at Scarborough, which have been considered to belong to some species of this genus. The *Venus Sinuosa* of Pennant, tab. XLV, fig. 51, A, has sometimes been found in a fossil state, in the chalk-rock of Flamborough. It is a small thin shell very convex, and is distinguished by a curious rising in the middle of the disk of one of the valves, with a corresponding sinus on the other. In a detached valve of a specimen of this genus, the hinge teeth were distinctly discovered.

VIII. *SPONDYLUS.—An inequilateral, inequivalved bivalve, frequently suborbicular, rough, and slightly eared. (Hinge with two thick recurved teeth.)*

An extremely rough shell, of a suboval shape, with a few rugose, tuberculated, longitudinal rays, and slightly eared; is not uncommon in the Malton neighbourhood; it has sometimes also, but rarely been met with at the Nab, and in the pyritaceous rocks to the north; we had placed it among the *Ostracites*, but the hinge teeth were afterward fortunately discovered. Length, from four inches to six inches; breadth, from three inches and a half to five inches and a half. M. Lamarck mentions a fossil of this genus, which is found in the pits in the neighbourhood of Paris, and which he describes under *Spondylus radula;* it bears certainly some resemblance to the species we have just described. The Malton specimens are composed of chrystallized carbonate of lime; those of the neighbouring coast exhibit the testaceous structure of the original shell, and may sometimes be split into thin pearly laminæ. Linnæus[*] observes that the *Spondyli* agree in their whole formation with the Oyster, except in their hinge teeth.

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[*] Lin. Syst. nat. 1128.

IX. *CHAMA.*[†]—*An inequivalved, generally inequilateral bivalve. (Hinge with one thick tooth.)*

A transverse shell with numerous longitudinal ridges; with an undulating surface, and curved beaks occurs in the alum-rock of Kettleness, and in detached masses of argillaceous stones, on the beach here; the hinge with one thick crenate tooth. It does not agree with any recent shell we are acquainted with, nor do we find it described by any oryctological writer we have had an opportunity of consulting.

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[*] Syst. nat. 1136.

[†] Syst. nat. 1137.

The alum-rock specimens are composed of a dark brown sparry matter, those of the coast, of a compact calcareous substance, often tinged externally with cherry-red. Length, an inch and three fourths; breadth, nearly three inches.

X. *ARCA.—An equivalved, inequilateral bivalve, oblong or round. (Hinge with numerous teeth inserted between each other.)*

An oblong shell with prominent beaks which occurs at the Nab in the Iron-stone, is a species of this genus. Mr. Sowerby, in his British Mineralogy, notices a similar fossil. Casts of shells will be seen in the limestone quarries, which are analogous to the *Arcites*; but we attempt not to assign to them any particular species of the genus.

XI. *PECTEN.*[*] *Scallop.—An inequivalved equilateral bivalve; the essential character of the Pecten is the trigonal sinus.—Eared; summit of the valves, straight; base, round and nearly circular; hinge, toothless. One muscular impression.*

The large *Pectenite* of the coast agrees with the *Ostrea Maxima* of Linnæus,[†] and *P. Maximus* of Pennant,[‡] except that the under valve is much more convex. It has fourteen prominent, broad, round rays, striated longitudinally—ears, equal. Occurs imbedded in the Ironstone, composed of a bluish or reddish matter, retaining the shelly lustre of the original. Superb specimens of the *P. Varius* variegated *Pecten* are found in the limestone of Appleton and Barton, near Malton. It is nearly an equivalved shell, the convexity of the valves being almost the same—has upward of thirty studded rays, and one ear much larger than the other, deeply striated. Length, from two to three inches; breadth, nearly the same. Specimens of *Pectenites* of a smaller size, sometimes siliceous, bearing the characters of *P. Pusio*, *P. Obsoletus*, and *P. Subrufus*, are found in the neighbouring limestone quarries, and in various parts of the coast. See those figured by Pennant and Lister. *A Pectenite* somewhat resembling the *Ducal mantle Pecten* of Da Costa, has sometimes, but rarely been met with in the quarries near Ebberston.

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[*] Lin. Syst. nat. 1144.

[†] Lister's English Conch. tab. 5, fig. 29.

[‡] Tab. 59, fig. 61.

XII. *OSTREA.* *Oyster.—An inequivalved bivalve; rough. (Hinge, toothless, consisting of one large gutter, running the length of the top of the valve, and filled with a strong cartilage. One muscular impression.)*

No fossil takes such variety of shape, and possesses so many distinct species as the *Ostracite;* even the small tract over which we extend our researches, teems with the genus. On the north-sands, whole rocks will be seen composed of little else but the remains of the different species of this shell; the limestone quarries of Malton, Pickering, Ebberston, Ayton, and Seamer, possess many fine specimens, and some species, which have not hitherto been met with on the coast. The following species have been distinctly made out ——*Ostrea Edulis.—O. Frons or Folium.—O. Canalis.—O. Diluviana.—O. Pectenata.—O. Pes felis.*

1. O. EDULIS.—*A rugose inequivalved bivalve; in form nearly orbicular.*

Several remarkable fossils of this species occur in the neighbourhood.

1. A large and nearly circular shell, composed of innumerable laminæ, heaped upon each other, and forming by their edges an extremely rugose surface. Length, sometimes eight inches; breadth, nearly the same; thickness, three inches. Colour, bluish, retaining in great measure the original testaceous lustre—from the rocks on the north-sands. It will be found very difficult to separate specimens of this species, from the matrix, as their brittleness is extreme.

2. A shell much smaller than the former, and slightly ovate—convex—valves smoother—analogous to the *Colchester oyster.*

3. A large subtriangular shell, with the beaks slightly pointed—convex;—valves, faintly striated transversely, and very thin. Specimens retaining the shell are rare—casts abound—from the limestone quarries. Length of some, ten inches;

breadth, eight inches and one fourth. Composed of calcareous spar, imbedded in Oölite, or roe-stone.

A part of the slaty cliff near the Spaw, which shot down a few years ago, presented to our view a most superb specimen of the species we are mentioning; it lay upon the mass of the aluminous clay, and apparently had undergone little change from the impregnation of adventitious matter. The shell measured eleven inches in length, and nine and a half in breadth; both valves were entire, and so extremely thin, as to be nearly transparent. The transverse striæ which we noticed in the quarry specimens were very distinct. Colour, whitish—had a pearly lustre. It was destroyed in attempting to remove it.

II. *O. Frons, or O. Folium,* of Linnæus.—An ovate, or elongated shell, with a regular curved form arising from the inclination of the beak toward one side. A slightly wrinkled fold runs along the disk of the valve, partaking of its curvature; from each side of which, rugose plicæ diverge to the margin, forming upon the whole the appearance of a leaf. The margin with obtuse angled teeth, caused from the elevation of the plicæ. Specimens of this *Ostracite* occur in the pyritaceous rocks on the north-sands; colour, bluish; composed of matter much resembling the recent shell. Length, three inches and a half; breadth, two inches and a half.

2. *Ostracite* resembling the former, with a deep groove running down the centre of the disk, with sharp diverging ridges. Margin, with acute angled teeth. Muscular impression, nearer the beak than the base. Composed of matter completely spathose. Length, two inches; breadth, one inch and a half. Occurs in a quarry on Seamer-moor, in the rocks to the south of the Castle-foot, and on Filey-bridge. It is a rare fossil.

III. *O. CANALIS.—An extremely long and narrow inequivalved bivalve.*—The under valve has a carinated form; the pit, long, deep, and arched; the beak, turning a little upward and inward—upper valve, flattish; both valves have a laminated formation. The length, varies from seven to ten inches, and the breadth, from three inches to four inches and a half; thickness, generally two inches. Composed of a dark brown spathose matter, which we conceive derives its tinge from the presence of petroleum. The component matter is so very frangible that it is almost an impossibility to obtain a perfect specimen—from the rocks on the north-sands, Fileybridge, and the limestone quarries.

IV. *O. Diluviana.**—A subtriangular shell.—Disks plicated rather regularly by folds considerably wrinkled, and proceeding till they arrive at nearly half down the valve, when they dichotomize and become considerably elevated; the margin, is formed by erect acute angled teeth. Colour, bluish, retaining the testaceous lustre. Length, four inches; breadth, at the broadest part, three inches and one fourth. It is figured by Parkinson, vol. 3, pl. xv, fig. 1. From the north-sands. It is a rare fossil.

v. *O. Pectenata.*—An oblong shell, with the disks regularly plicated from the beak to the margin, after the manner of the *Pectenite.* Margin, serrated. It has a very rough exterior, caused by transverse striæ. The beak much turned up—the cicatrix or muscular impression, nearer the beak than in most species of the genus. May be distinguished from the *Spondylite* by its want of teeth, and from the *Pectenite* by its want of the trigonal sinus—from the north-sands.

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* Lin. Syst. nat. 1148.

6. *O. Pes felis.*[*] *Cat's-paw.*—A small inequivalved bivalve, with eight or nine rough radii, rising in tubercles toward the margin. Slightly eared. Length, nearly two inches. Occurs on Filey-bridge. It is a rare fossil.

Among the species of *Ostracites* we place a small thin circular convex shell, with one ear much larger than the other; the valves regularly striated by innumerable filiformed longitudinal striæ, and traversed by frequent concentric ones. It abounds in the neighbourhood of Malton. Length, two inches.

We have seen fragments of *Ostracites* in the neighbourhood greatly resembling the *O. Deltoidea, O. Crista Galli, O. Deformis, &c.* of Lamarck, but till such time as more perfect specimens can be obtained, we must delay entering into any description of them.

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[*] Lin. Syst. nat. 1146.

XIII. *GRYPHÆA.—An oblong inequivalved bivalve, the lower valve hollow, and terminated by a beak, curving upwards and inwards; the upper valve, flat, much resembling that of an Oyster; the hinge inarticulate, the pit ovate and arched; one muscular impression in each valve.*

The *Gryphites* are vulgarly called *Millers'-thumbs, Boat-oysters, &c.* The most common species has the under valve tolerably smooth—the beak considerably turning upward and inward—the pit, long and narrow. Composed of a bluish substance, apparently of the same nature as that of a recent shell, takes an excellent polish displaying in that case a perlaceous lustre. Occurs all over the coast in the greatest abundance.

A second species has the under valve very rugose, the beak less incurvated—the base much broader, so that the pit becomes nearly circular. It is remarkable that the upper valve is rarely discovered with the under one. Specimens of this fossil are chiefly to be met with in the yellow sandstone-rocks of the north-sands. Da Costa, and Bruguiere, consider the *Gryphite* as a species of *fossil oyster*; Linnæus has put it with the *anomiæ*, and Lamarck has placed it under a distinct genus.

XIV. *TEREBATULA.—An inequivalved bivalve, under valve the largest, the beak of which is incurvated like the Gryphite, and perforated with a hole nearly circular, through which a strong ligament passes, and by which the habitat fastens itself to rocks, or other substances.—(Hinge with two teeth.)*

1. With both valves convex, and a little roughened by frequent transversal undulating laminæ. Composed of a bluish calcareous matter. Length, varying from two to three inches.

2. With the upper valve nearly flat—the beak of the under valve but little produced. Valves, almost smooth. Length, an inch. This is probably only the young shell of the foregoing. Occurs at Malton.

3. A small shell differing essentially from the former species, having the valves longitudinally ribbed, the margin dentate, the under valve with a deep broad sulcus on the disk, causing a corres-

ponding elevation on the upper one; the beak perforated and slightly produced. The exterior is commonly nacrous. The nucleus is composed in general of translucent white calcareous spar; sometimes it is chalcedonic. Occurs on the north-sands, imbedded in the sandstone-rocks, in great abundance, on the summit of the hill called Stone-Hags, at Malton, and Bridlington. Resembles the *Terebatulites coarctatus* of Parkinson, see vol. 3, pl. XVI, fig. 5; see also in Sowerby's Brit. Min. the figure at the bottom of pl. LV, vol. 1.

XV. *MYTILUS.** *Mussel.—An equivalved inequilateral bivalve, of an elongated form, narrow and convex.—Beaks, straight and terminal.—(Hinge without teeth) one muscular impression.*

The *Mytilite* answering to the *M. Edulis, or Common Mussel,* is very common in the pyritaceous rocks on the north-sands, in the freestone quarries of Falsgrave, Cloughton, and Troutsdale. It occurs also in the limestone of Ayton, Seamer, Ebberston, and Malton.

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* Lin. Syst. nat. 1155.

2. *Mytilite*, agreeing with the *M. Incurvatus* of Pennant, tab. LXIV, fig. 74, occurs in the Seamer quarries: it coincides with the *Common Mussel*, except that it is much bowed on one side, much narrower at the beaks, and considerably broader toward the base. Length, two inches. It is rare here.

3. A very large and exceedingly thick fossil shell with rugged valves, the beaks much blunted, and the sides dilating. Were it not for the uncommon thickness of the spathose matter, which is now the representative of the testaceous substance of the recent analogue, and the great roughness of the exterior, this fossil would coincide with *M. Modiolus* of Linnæus,[*] which is figured by Lister[†] and Pennant.[‡] Length, from four to five inches.

4. *The Mytilus Lithophagus*, the stone-eater, of Linnæus, occurs in the neighbourhood, in a state of mineralization, composed in general of a translucent calcareous spar of a yellowish tinge; it is a small, and nearly cylindrical shell—rounded at both

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[*] Lin. Syst. nat. 1158.

[†] Conchol. tab. 356, fig. 195.

[‡] British Zool. vol. 4, tab. 66, fig. 77.

extremities—a little broader at the base than at the beaks.

Upon inspecting the limestone quarries of Ayton and Malton, large masses of the rock will be seen perforated in all directions by this shell, which is not unfrequently found in the cavities it has made. Were there no other argument for the marine origin of these rocks, this certainly must be deemed conclusive. The perforations we allude to are circular and straight; the ravages of a recent shell of this species, are very discernable on the shores of Whitby and Bridlington.

5. A shell cut off like the *Donax*, which occurs in the aluminous shale of Whitby, and sometimes in the nodular masses of the alum-stone of the beach here, is a species of *Mytilus*. Composed of a thin, brownish black spathose matter. Mr. Sowerby has given a figure of this fossil. The beaks are not terminal.

6. A transverse shell, with the beaks not terminal, but inclining toward one side—less convex than the former species—valves, marked with concentric striæ. Length, two inches; breadth, three

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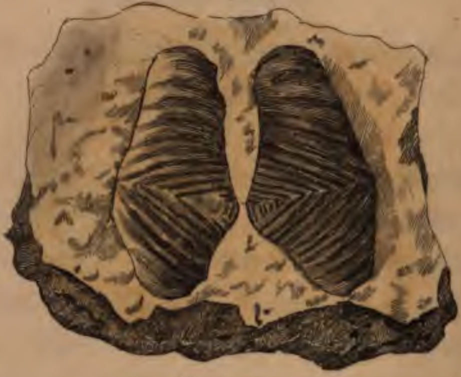

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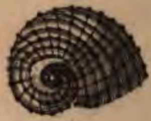

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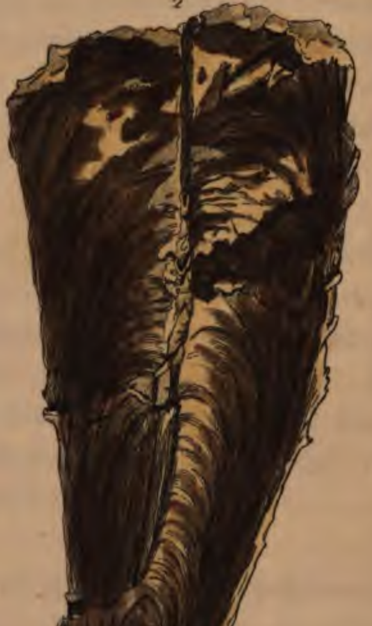

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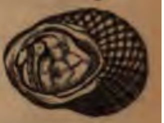

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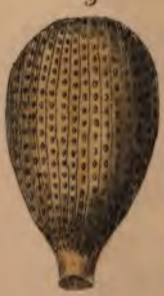

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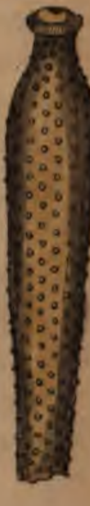

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inches and one fourth. Composed of a thin spathose matter. Has great affinity to the *Mytilus Anatinus, Duck Mussel.* Occurs at Malton, and in the rocks on the north-sands.

7. Shell resembling the foregoing, but with the valves composed of a thick spathose matter deeply marked transversely—much broader—with the end nearest the beaks blunted, and the other subacute: its localities are the same as the former. Having had several opportunities of examining the hinge, and not having discovered any teeth, we have placed it here.

XVI. *PINNA MARINA.*[*]—*A cuneiformed, or wedgeshapen bivalve.—Valves, triangular—expanding from a pointed base to a very broad end, which gapes, and is always open. The hinge, inarticulate, and on one side of great length.*

The *Pinnite,* figured pl. II, fig. 2, has its valves marked longitudinally with slight ribs, traversed by semilunar ones a little elevated, so that they have upon the whole a roughened aspect. The curvature, we conceive to be accidental. The shell is now composed of nothing more than a thin ferruginous crust, of a dark brownish red colour: it was taken from the freestone quarry of Falsgrave-moor; analogous to the *P. Rudis* of Linnæus. Length, five inches; breadth, three inches in the broadest part.

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[*] Lin. Syst. nat. 1159.

Specimens of the above, occur also at Cloughton and Troutsdale. Fragments of a *Pinnite,* will be met with in the aluminous rocks in the neighbourhood, composed of a splendent pyritous crust, having one half of the valve longitudinally striated, the other half transversely lunated. Bear some resemblance to the *P. Pectenata* of Linnæus. Specimens of this description will be discovered in the alum-works of Stowbrow, Whitby, &c. The *Pinnite* is considered a rare fossil.

XVII. *TRIGONIA.—A subtriangular, inequilateral, equivalved bivalve.—On the right valve are two oblong, flat, diverging hinge teeth, transversely grooved on one side only, disposed in pairs—each pair diverging, and exactly receiving those of the opposite valve.*

The recent analogues of several species of the fossil *Trigoniæ,* remain undiscovered; from their beauty, and curious formation, they constitute one of the most elegant features of fossil conchology. These fossils have been denominated, *Curvirostræ* by Lhywdd,* *Cunei* by Da Costa, and *Trigoniæ* by Bruguiere.

The following species of these interesting fossils, have been met with in the district—*Trigonia Clavella; T. Costata, and T. Aliformis.*

1. *T. Clavella.*——A trigonal, inequilateral bivalve, with a sloping surface on the anterior side, which gradually expands from the beaks to the anterior termination of the valves. The disks of the valves are studded by transverse undulating rows of elevated tubercles. The sloping anterior side, which is transversely striated, is decorated with three crenate ridges; the innermost of these in each valve enclose an eccentric elliptical area, slightly striated in the direction of the length.

It is figured by Parkinson, pl. xii, fig. 3, vol. 3; and by Da Costa in his elements of conchology. Composed of a thick calcareous spar, never retaining any traces whatever of a testaceous origin.

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* Lithol. No. 700.

Occurs in great abundance, in the limestone quarries near Pickering, generally with single valves; in the pyritaceous rocks on the north-sands, with both valves coalescent, and extremely brittle; and in the limestone rock of the castle.

2. *T.* COSTATA.—A trigonal and inequilateral bivalve, with a sloping surface on the anterior side, which gradually expands from the beaks to the anterior termination of the valves.

The disks of the valves are traversed by equidistant, and slightly rounded ribs, containing between them a deep rounded sulcus, and passing with a slight curve from the posterior margin, to an elevated crenulated ridge, which divides the anterior sloping surface from the disks; and here we have three longitudinal crenulated ridges, with six smaller inserted between each, the innermost of the larger ridges in each valve contain an elliptical area, faintly longitudinally striated.

The localities of this fossil are the same as the preceding; it is very rare in the limestone quarries.

There is a slight difference between the specimens from the limestone, and those from the north-sands; the former are more closely ribbed than the latter. Figured by Parkinson, pl. XII, fig. 4, vol. 3.

3. *T. Aliformis.*—Mr. Parkinson's* description of this fossil is so admirably correct, that we shall give it in his own words.—"A wing-shaped ribbed shell. The first ribs, which commence at the beaks of the shell, are transverse, but acquire a slanting direction as they fill up the posterior part of the disk, until those which terminate in the superior margin become longitudinal, and are thus continued to the anterior termination of the shell. The ribs of the posterior side augment in size as they proceed to the margin; but those which are disposed on the anterior side, are of the same size through their whole length. On the inferior, or rather anterior side, is a wide excavated area, on each side of the cartilaginal depression and the margin of the shell, on which transverse ribs are disposed. Pl. XII, fig. 9."

The *T. Aliformis* is much smaller than either of the two preceding species, the specimens we have seen, measuring scarcely an inch from the beaks to the anterior termination of the valves. It has hitherto been discovered on the beach here, detached from the matrix; few specimens have occured.

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* Organ. Rem. vol. 3, p. 176.

Fossil shells answering externally to the characters of the *T. Eccentrica, and T. Rugosa,* have been met with here; but we have had no opportunity of examining the teeth.

In concluding the list of bivalves, we must not omit a most interesting fossil shell, which occurs in the greatest abundance in the rocks on the north-sands, and in the neighbourhood of Malton.

This fossil has not hitherto been consigned to any genus of shells by conchologists. It is a transverse, equilateral and equivalved bivalve, the beaks rather prominent, and turning a little inward. The valves are marked by slightly curved grooves, proceeding obliquely from the margin of each side of the shell to the centre of the disk, where they meet, forming obtuse spherical angles, which grow more acute as they approach the base. The grooves which are remote from the beaks, do not meet but terminate in the base. The valves are also faintly striated concentrically. Fig. 1, pl. II, is a specimen of this fossil, with the valves in an extended state, imbedded in the grey limestone of Malton. It is also figured by Mr. Parkinson, pl. XIII, fig. 16, vol. 3.

XVIII. *NAUTILUS.*[*]—*A spiral or revolved, many-chambered, globose, and discoidal univalve; the whirls contiguous, and returning into the shell after the first circumvolution, and are of course invisible externally. The chambers are divided by transverse septa, pierced by a siphunculus or tube, and are small when compared with the last, which is the residence of the habitat.*

The above is a general description of the *Nautilus*; and includes not only such as have occured in a recent state, but the fossil species also.

The distinction between the *Nautilite* and the *Cornu-Ammonis,* consists not, we conceive, either in the form of the diaphragms or septa, or the situation of the siphunculus, but in the disposal of the whirls; the former as we before observed concealing them after the first circumvolution, the latter displaying them throughout every turn.

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[*] Lin. Syst. nat. 1161.

It would be foreign from the purpose of the present work, to enter into any particular detail of the economy of this shell: it is well known that the whole mass, from the air contained in the chambers, is rendered as nearly equal to the weight of water as possible, so that by the inflating, or exhausting of the siphunculus, the animal has the power of raising or sinking itself, or continuing at any depth it pleases.

The fossil species which have been discovered in the district, are as follow:

1. *Nautilite*—in form globose, with hemispheroidal transverse septa, with the concave side outward; and pierced nearly in the centre of the disk by the siphunculus. The exterior of the shell is faintly transversely striated; and has five, seven, or more slightly rounded elevations placed at equal distances, and proceeding with a gentle curvature from the margin of the disk to the centre.

The shell of the *Nautilus* is, in general, transmuted into a dark brown spathose matter, having externally the appearance of enamel—sometimes it is composed of a resplendent nacrous substance, resembling the pearly interior of the recent analogue.

It frequently happens that the spathose crust, representing the external whirl of the shell, is destroyed, so that the edges of the septa become visible, and it is from this circumstance, that the species we are describing, has obtained the name of the *lobster-tailed Nautilite.*

It is remarkable, that this species is rarely found either incrusted or impregnated with iron-pyrites; some of the cells contain petroleum.

By passing a saw perpendicularly through the back, so as to divide the fossil into two equal parts, we obtain a section, which cannot sufficiently be admired—the whole construction of the shell is displayed; the whirls which we lose on the outside are exhibited in an elegant and regular spiral, the edges of the septa dividing it into compartments, and the siphunculus proceeding midway and nearly parallel to it.

ribs. The exterior of the first revolution is, as we observed in a foregoing species, generally destroyed, displaying the edges of the sinuous septa: nothing can be more beautiful than the appearance which they assume, and particularly so, when the septa are pyritous or agatized; the whole disk, together with the back, is ornamented by the most elegant foliage, arranged in festoons, and vying with the finest embroidery or needle-work, having more the semblance of the work of the most correct artist, than the irregular sports of nature—see the specimen figured, pl. III.

The polished sections of this species are equally as beautiful as the former, the siphunculus, however, from its situation, is never so discernable, as the membranous part is almost always destroyed: the testaceous part however will readily be detected on inspecting the back, proceeding to about one fourth part of the chamber.

From what cause we have not been able to determine, but we have remarked that this species is almost universally impregnated with pyrites; indeed in many instances the exterior shell, the septa, and the siphunculus are entirely constituted of it; in

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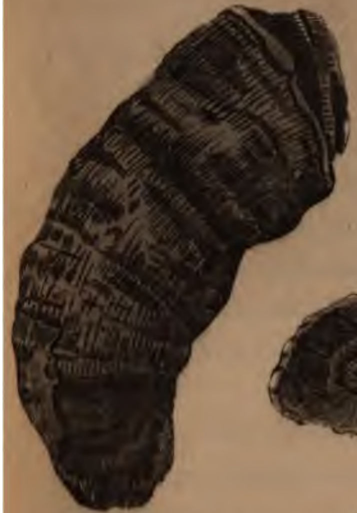

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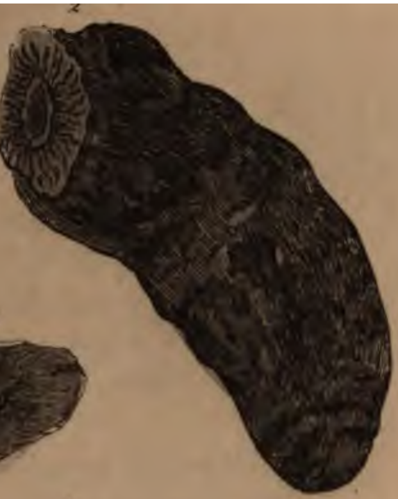

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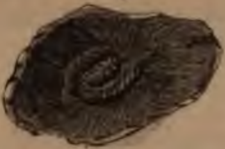

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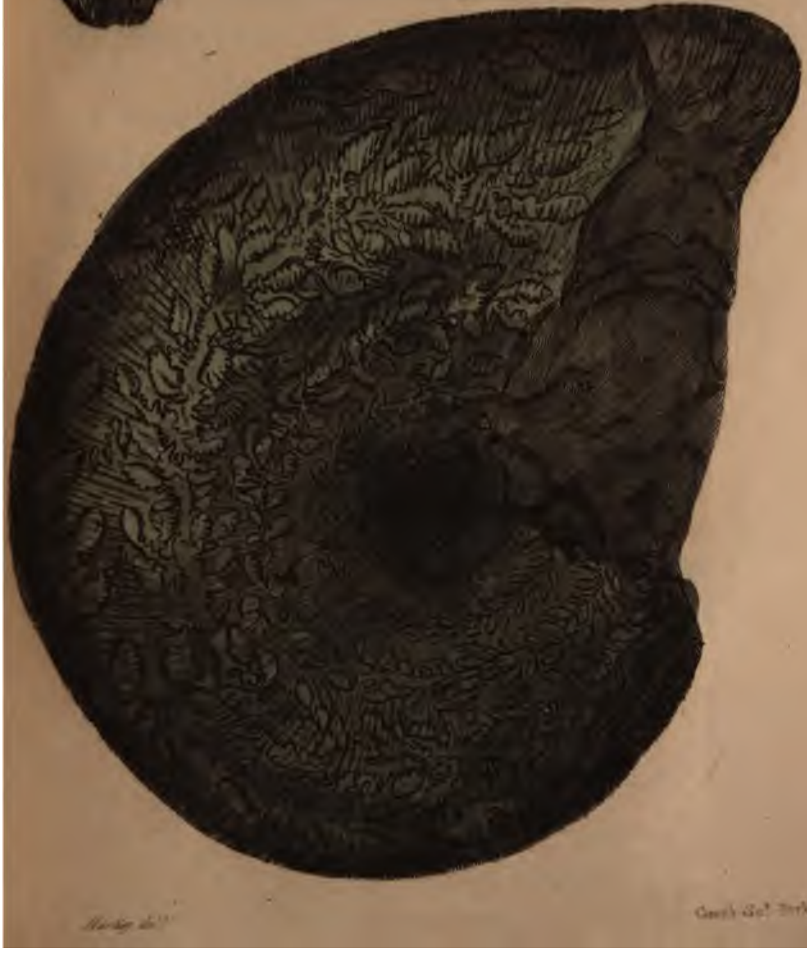

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this case the polished sections have an additional elegance; then we see the sections of the whirl as well as those of the septa, meandring amid the pellucid spathose matter, filling the natural cavities of the shell, like wires of burnished gold, forming a picture, at once wonderful and ornamental.

The localities of this fossil are the same as those of the first species—some specimens have been discovered nearly a foot in diameter.

4. *Nautilite*—in form, discoidal—back with a sharp ridge—the sides rising considerably from it—septa foliaceous—siphunculus running along the back. Occurs in the neighbourhood of Malton, composed of a greyish coloured compact roestone. It is a rare fossil.—Exceeds in some instances a foot in diameter.

From the wonderful form of the diaphragms, it may naturally be expected that the casts of the chambers of these multilocular shells must be equally so; these casts, as well as those of the *Cornu Ammonis* and *Ammonoides*, have obtained the name of *Spondylolithes* or *knuckle-stones;* it is almost impossible accurately to describe their form.

XIX. *AMMONOIDES.—A spiral or revolved polythalamated univalve; globose; the whirls, contiguous and manifest externally; the remaining ones bearing a very small proportion to the last. The chambers are divided by foliaceous diaphragms, pierced by a siphunculus at the superior part, and which runs along the back.*

This genus differs from the *Nautilite* on the one hand, by having its folds visible externally, and from the *Cornu Ammonis* on the other, by its globose form. From the vast disproportion of the outermost whirl, and the tapering tendency of the succeeding ones, the centre of the fossil presents a deep conical cavity. The following species have occurred.

1. *Ammonoides*—with a round and nearly semicircular back——with frequent well defined straight sulci traversing both back and sides. On the detritus of the external coat, the foliaceous sutures present the same appearance as those of the *Nautilite*. Occurs in great abundance in the rocks on the north-sands—measuring sometimes seven inches in diameter.

2. *A.*—In form similar to the preceding, but with sigmoidal ridges on the sides, which meet at the middle of the back, forming an obtuse spherical angle. Occurs also on the north-sands, and is nearly of the same size as the former, but rarer to be met with.

3. An immense fossil, which from the very small angle, which the sides make with the back, is in form, nearly cylindrical: the margins of the sides are sharp ridges, studded by a row of contiguous large knobs; the cavity in the centre is so large, as nearly in some instances to contain a pint of liquid. The whole exterior of the fossil is grooved by deep and nearly straight sulci, proceeding from the margin of one side to that of the other.

From some peculiar conformation of the septa, a narrow and nearly unornamented space runs down the centre of the back, giving an admirable effect to the imagery of the foliaceous sutures. It is a rare fossil, and has hitherto occurred only on the north-sands: measuring upward of a foot in diameter, and seven inches from the tubercles of one side to those of the other.

XX. *CORNU AMMONIS.*[*] *AMMONITE, or SNAKE-STONE.—A concamerated, or chambered spiral univalve; discoidal; the whirls contiguous and all of them visible externally.—The chambers are divided by sinuous or foliaceous diaphragms or septa, which are pierced by a siphunculus at the superior part, and which runs along the middle of the back.*

Whitby has long been justly celebrated as the matrix of these most interesting fossils, and monkish superstition did not neglect to avail itself of so favourable a circumstance to impose upon its votaries, by attributing their existence to miraculous agency, and

> "......................told
> How, of thousand snakes, each one
> Was chang'd into a coil of stone,
> When holy Hilda prayed;
> Themselves within their holy bound,
> Their stony folds had often found."
> MARMION, *Canto* II, v. 13.

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[*] Lin. Syst nat. tom. III, p. 162.

It will be seen by referring to the different authors who have written on these fossils, as Langius, Bromel, Lister, Breyn, Da Costa, &c. that some of them have fixed upon the conformation of the back, as the distinguishing characteristic of the species; whilst others attend to the markings of the sides.

Thus in respect of the back, we have observed it in this district, in the several species to be striated, sulcated, or ribbed—with a single prominent ridge, plain, wreathed, or jagged—with a plain, wreathed, or jagged ridge between two furrows—with a single furrow—with a single or double row of tubercles or spikes, &c.

As to the sides, we have seen them smooth, striated, tuberculated, grooved, or ribbed. The striated markings are straight, waved, and sigmoidal—the tubercles are in single, double, or in triple rows, but never so arranged as to be opposite each other, but in quincunx order—the ribs are sometimes prominent and remote, straight and parallel, rounded or sharp; sometimes frequent, straight, and parallel; often a little waved; there is also another peculiarity in the disposition of the ribs; in approaching the sides they will often bifurcate and trifurcate, and in that state will traverse the back, and reunite on the opposite side; besides, the ribs will some of them proceed but half way down the sides, or alternate with others that are longer.

From the above observations it is evident that the species of the *Ammonite* are very numerous; they have been variously stated by different authors; Rosinus was of opinion that they are not less than three hundred; and as Mr. Parkinson remarks,* "When it is considered that each of the modifications of form of the sides of the shell, may be combined with every different form which is assumed by the back; and that the number of species thus yielded, will be the number of the different forms of the sides, multiplied by the number of different forms of the back, the number of species will be found far beyond expectation.

The number of species is, however, not confined by even these limits; since colour, another source of change, and of multiplication of species, remains yet to be considered. It is true, that of this source we cannot avail ourselves in the enumeration of fossil shells; but it is certainly fair to examine how far it may have been likely to have multiplied the number of species of this shell in a recent state, which in a fossil state, and without this addition, we have seen to be so very numerous.

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* Organ. Rem. vol. 3, p. 135.

In the genus *Conus*, Linnæus admits seventy-one species; and in the genus *Cypræa*, one hundred and fourteen species; and in both these genera, the figure of the shells so approximate to uniformity, as to allow it to be said, that the chief of the specific distinctions which have been had recourse to in them, have been those of colour, varying in its hues, and in the forms in which it has been disposed.

Reckoning, therefore, upon the still farther multiplication of the species of this genus, by distinctions arising from the various differences as to colour, combined with the numerous distinctions as to figure, it may be concluded, that the number of species comprised in this genus, in a recent state, must have been immense; although at present we know not of the existence of a single individual."

There is another circumstance which ought to be taken into the account, and which will still further increase the number of species, the angle formed by the sides with the back; this will cause a material difference in the conformation of the whirls, according as the angle is obtuse, right, or acute.

The folds, therefore, in these different cases may be either cylindrical, oval, with flat sides, or compressed sides, and it will be found that each of these four conformations will, in great measure, participate in all the modifications arising from the multiplication of the markings of the back by those of the sides.

The form of the siphunculus is a uniform cylindrical tube, which will very easily be traced in many of the Whitby specimens, in particular along the back of the exterior whirl; in the remaining whirls it gradually decreases, so that at length it becomes lost; in the large specimens from the Malton quarries, and especially so when they are constituted of translucent calcareous spar, we have seen the siphunculus forming a cylinder, nearly one third of an inch in diameter, running along the middle of the back.

It has been said that in some species of the *Cornu Ammonis*, the siphunculus pierces the inferior part of the septum, but we have never been able to detect it in that situation.

These fossils pass through all the gradations of size, from half an inch to nearly two feet in diameter.

Iron-pyrites in many instances, and particularly in the neighbourhood of Whitby, constitutes either the entire substance of the fossils of this genus, or covers the surface of them in form of a thin film, or burnished metallic wash.

In the blue loamy clay-pits of Knapton, some specimens of the *Cornu Ammonis* have been discovered with a nacrous or perlaceous covering, possessing a highly brilliant and resplendent lustre: whether this beautiful appearance is really the original testaceous matter of the recent analogue, or that matter transformed by the process of mineralization, is still a matter of doubt; it certainly exceeds in brilliancy the nacrous coat of the interior of the *Nautilus*.

Mr. Whitehurst* informs us that he had in his possession "a fragment of a *Cornu Ammonis*, dug up near Northampton, which retained its native shell;" he adds—"In Sir Ashton Lever's excellent Museum, there are several curious specimens of the *Cornu Ammonis*, with their native shelly matter remaining: such instances are rare, and of great value, pointing out the original of them.†"

After what has been observed above, we have deemed it unnecessary to enter into a minute description of the different species; and we shall, therefore, only enumerate a few of the most remarkable, and first of those with *cylindric whirls*.

1. With smooth back and sides—of a small size, and very rare.

2. With straight frequent transverse ribs, marking both back and sides.

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* Theory of the Earth, p. 51.

† See a disquisition on the Cornu Ammonis in vol. III, p. 287, of the voyage of M. J. F. G. De La Perouse, by that indefatigable, and ever to be lamented philosopher M. De Lamanon.

3. With straight remote transverse ribs, with a broad rounded sulcus between each, marking the sides only, as in the large Malton specimens; these are composed of a mixture of oölite and translucent calcareous spar; in size nearly equal to the fore wheel of a chariot. *Ammonites* of this description, though of a much inferior size, occur in the slaty cliff, near the Spaw, in aluminous nodules, constituted of a blackish spathose matter; we have seen some small specimens of this species composed of a pure translucent chalcedony; these are extremely beautiful, but are very rare.

4. With frequent transverse ribs which bifurcate or trifurcate as they approach the back, &c. &c.

II. *Of the most remarkable of those Ammonites, whose folds are oblique, or those whose sides form a right angle with the back.*—In this division will be found all the markings of the former, and many additional ones.

1. With a plain prominent ridge at the back, with straight remote ribs at the sides. At Malton this species occurs of a large size, equal to that mentioned in No. 3. of the first division—the

chambers are frequently hollow. At Whitby and Stow brow, fossils of the same kind have been discovered, constituted entirely of iron-pyrites.

2. With the back the same as the above, but with frequent straight ribs. Occurs near the Spaw at Scarborough.

3. With a single ridge between two furrows, and curved ribs on the sides.

4 With a depression on the back, and with the ribs proceeding half-way down the sides.

5. With a single row of tubercles on the exterior rim of the sides, which, as well as the back, are traversed by frequent straight ribs. The two foregoing have been found in the greatest quantities at Stowbrow.

6. With frequent acute ribs, which meet at a minute dorsal line at the ambit, forming an acute angle, something resembling the head of an arrow; this species is vulgularly termed here the *herring-bone snake-stone.* It is a rare fossil, and is never of a large size, &c. &c.

III. *Of Ammonites, whose sides form a right angle with the back; in this case, the sides as well as the back are flat.*

1. With a deep channel running along the middle of the back; the sides, with broad flat ribs ending in a curved line, and proceeding from the back to a ridge parallel to it, nearly in the centre of them; the remaining half of the side being nearly plain.

2 With a single ridge between two furrows—sides as before.

3 With two ridges, with a furrow between them, &c. &c.

IV. *Of Ammonites, whose sides form an acute angle with the back.*

1. With a sharp, prominent ridge; the sides, with frequent undulating striæ.

2. Back as before, with sigmoidal ridges at the sides, which terminate at the dorsal ridge.

3. With a wreathed, prominent ridge, and frequent curved ridges at the sides.

4 With a serrated or jagged ridge, sides as above.

5. With a single row of spikes or tubercles on the back; sides, with undulating striæ.

6. With a double row of alternate spikes on the back; the sides, with a single row of spikes in the midst, through each of which a rib passes, thence dichotomizes, and remains in that state till it reaches the first row of spikes, when it unites and passes to the second row, &c. &c.

There is a remarkable difference between the conformation of the whirls of this division and those of the preceding—the exterior whirl in this case being out of all proportion to those which succeed.

In making a collection of the various species of *Cornu Ammonis*, great care ought to be taken to procure perfect specimens, since it will frequently happen that the exterior coat of the *Ammonite* will cleave to the impression, so that we may be led to conceive we have obtained a new species, when in reality, we possess but the cast of one familiar to us.

When the exterior coat of these fossils is removed, the foliaceous sutures exhibit an embellishment, similar to what we have remarked in the *Nautilites*; the polished sections also of those whose matrix is aluminous, are uncommonly elegant.

Specimens of the *Cornu Ammonis*, besides the places already mentioned, occur at Bridlington, on Filey-bridge, at Speeton, on Langton-Wold, at Flamborough, &c.

XXI. *ORTHOCERA.*[*]—*A straight, nearly conical, elongated concamerated univalve; the chambers are divided by transverse, and nearly hemispheroidal septa, which are pierced by a siphunculus near the edge.*

Various have been the opinions of naturalists respecting the *Orthoceratite;* the illustrious Linnæus, from its similarity of construction in respect to the diaphragms and siphunculus, considered it as belonging to the genus *Nautilus,* and has termed it *Nautilus rectus.*

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[*] Lin. Syst. nat. 1164—see also vol. 3, p. 162, of the same Syst.

Lhywdd has designated these fossils *Alveoli,* and doubtless referred them to the *Belemnite.*

Scheuchzer has given them the same appellation, but has considered them apart from that fossil.

Kleyn and Breyn, with Vogel and Woltersdorf, were convinced that these fossils were the exuviæ of some multilocular marine shell which has now ceased to exist.

The fossil, *Orthocera,* in the state which the coast presents it to us, is nothing more than an accumulation of hemispheroidal, concave caps, fitting upon each other, and regularly decreasing from the base ; from this circumstance the exterior is marked by equidistant annular lines, showing the articulation of each cap.

This shell has doubtless had an external coat, similar to the *Nautilus,* but it must have been uncommonly thin and delicate, since it is invariably destroyed, and the edges of the septa are ever visible.

The siphunculus is in form cylindrical, and its diameter bears a much greater proportion to the diameter of the septum, than that of the *Nautilus* does.

The *Orthoceratite* occurs in the alum-shale in the neighbourhood of Whitby, constituted almost entirely of pyrites; in this state it is easy to separate the septa from each other, and it will be seen, that they are both on the concave and convex sides, glazed with a resplendent metallic wash: some specimens are composed of a compact black spathose matter, which has the appearance of enamel, and particularly those from the Peak alum-works; fragments of this fossil have also been discovered at Knapton, possessing the original testaceous lustre.

These fossils are very frequently discovered crushed, and variously mutilated; sometimes they assume a curved form from the dislocation of the septa; they vary in size, from two inches to seven inches in length, and from half an inch to two inches in diameter at the base.

Besides the localities abovementioned, the *Orthoceratite* has been met with in the cliffs here, and at Speeton and Bridlington; it is by no means a common fossil.

XXII. *BELEMNITE.**—*A straight, elongated cylindrical fossil, assuming a conical form toward one extremity, and terminating in a point—the base has a conical cavity naturally containing within it a conical body, divided into compartments by horizontal hemispheroidal septa, with a siphunculus piercing their edges, after the manner of the Orthoceratite.*

This fossil has long occupied the attention of the lovers of natural history, and various have been the conjectures formed respecting it; some have considered it to be a *lapis sui generis,* as Woodward and Da Costa; some that it has been the tooth of an animal, and among these we find the celebrated Lhwydd; others have fancied it to be a species of the *Alcyonium;* some again have assigned it a vegetable origin, others that it is a *Stalactite;* in fine there is no end to the suppositions and absurd notions which have been adduced by authors of almost every age. Nor less absurd are the names it has obtained, as *thunder-bolts, devil's-fingers, spectrorum candela, lapides lyncis, &c.*

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* Lin. Syst. nat. vol. 3, p. 170, No. 23.

Linnæus, Erhart, and others, are of opinion that the *Belemnite* is the remains of some marine animal which has ceased to exist, and this opinion seems to be supported by analogy and the whole conformation of the fossil.

As to the economy of the animal to which the *Belemnite* is considered to have once belonged, it is involved in darkness, and notwithstanding all the ingenious and learned disquisitions, which have been set forth respecting it, we cannot but look upon them with distrust.

The fossil, from the definition, contains two distinct parts, which require a separate examination.

The exterior part is composed of a radiating spathose matter, varying in colour, from black to blackish brown, and brownish yellow; it possesses, also, various degrees of opacity, from being completely opaque, to a tolerable degree of translucency.

The radiating chrystals, which present themselves on making a fracture of the solid part of the external body, are intersected by numerous concentric circles, and very rarely diverge from the centre of the cylinder, but from a point near the side.

In the form of this fossil there is great variety; sometimes the cylinder terminates abruptly, sometimes gradually from the base, and then the aspect is conical; also toward the point will frequently be observed three or more sulci, converging to it, causing the fossil to assume a pyramidical form; the point also is sometimes rounded, and sometimes much acuminated.

Whether these formations warrant the considering them different species, we presume not to determine—they will also be found much compressed and variously distorted.

A cleft or crack proceeds from the base of this spathose external body to the apex, in an irregular manner; this has by some been considered as an external duct or siphunculus, we confess that were it not from its invariable occurrence, we should view it as the effect of chance; this is noticed by

Sir J. Hill; see also the ingenious conjectures of M. Walch in the *Monumens des Catastropes,* Mr. Platt in the *Philos. Trans.* &c.

When this body has suffered from weather, the concentric laminæ will sometimes peel off, after the manner of the *Oyster* and other marine shells, so that we are led to conceive them to be the different increments of growth.

As to the concamerated conical body contained in the base of the external spathose cylinder, it is composed like the *Orthoceratite* of an accumulation of concave hemispheroidal caps, which gradually decrease from the base to the apex, when they become so very minute, that the articulation is scarcely to be discerned with a good lens.

The edges of the septa are generally covered with a thin nacrous crust, and the septa, also, in many cases are composed of a resplendent pearly matter, resembling mother of pearl, evincing at once the testaceous origin.

As to the siphunculus, it is rarely to be discovered, indeed all that appears of it in our specimens is a sort of minute sulcus, which traverses the side of the conical body, from the apex to the base, in a right line; this, however, we are led to suppose is the siphunculus, which by being placed so very near the edges of the septa will, on the detritus of the thin crust envelloping them, break out into one continued channel.

The *Belemnite* is rarely to be obtained entire, from its extreme brittleness. The size of these fossils varies from an inch to eleven inches in length, and from the fourth of an inch to four inches in diameter.

*Alum-shale, roe-stone,* and *iron-stone*, are equally the matrices of these fossils; we have seen them imbedded in a mass almost completely pyritous, with the exterior body entirely free from its impregnation, and the interior one highly charged with it.

Several complete specimens have been discovered in the neighbourhood of Malton, at Whitby, on the north-sands, imbedded in the yellow sandstone, in the chalk-rock of Flamborough and Specton, &c.—fragments will be seen scattered all over the coast.

XXIII. *CONUS*[*]*—A convoluted, turbinated, univalve—the aperture,*[†] *long, narrow, toothless, and not contracted at the base—the columella smooth.*

Shells of this genus are rare here; some few specimens have occured in the neighbouring limestone, which bear the characters of the genus; but we are at a loss to what species to refer them, since colour is attended to in the arranging of recent shells, which is rarely to be discovered in those in a fossil state.

The fossils above hinted at, have some of them channelled, and some of them nodular spires.

XXIV. *VOLUTA.*[‡]*——A spiral subventricose univalve—aperture, narrow—the columella, plicated.*

A shell of this genus of an ovate form, and generally incrusted with pyrites, has sometimes been discovered in the aluminous shale of Whitby and Stowbrow.

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[*] Lin. Syst. nat. 1165 No. 319.

[†] The difficulty of discovering the hinge teeth, prevents us from ascertaining many genera of bivalved fossil shells; and in univalves, also, the same difficulty arises from the envellopement of the aperture or mouth.

[‡] Lin. Syst. nat. 1186, No. 322.

Mr. Parkinson* was acquainted with a similar fossil, which he assigns to that neighbourhood.

XXV. *BUCCINUM.* *Whelk.—A spiral, ovate, elongated, univalve.—Aperture oval, ending in a short canal—columella, convex, full, and naked.*

The *Buccinum undatum* is sometimes found in a fossil state on Langton-wold. It has its spires deeply transversely undulated, and slightly spirally striated. Length, four inches—composed in general of a translucent calcareous spar—See Lister, tab. DCCCCLXII, fig 14—Pennant, tab, LXXIII, fig. 90, and Montague's *Test. Brit.* 237.

The spirally tuberculated shell, with the first whirl exceedingly ventricose, approximates to the *Buccinum clavatulatum* of Lamarck. We have not seen a perfect specimen.

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* Org. Rem. vol. 3, p. 56.

† Lin. Syst. nat. 1196, No. 323.

At Ayton, Seamer, Malton, and in almost all the neighbouring limestone quarries, will be found in the greatest abundance casts of shells of this genus; the exterior of the most perfect specimens is regularly spirally striated, and has sometimes an uncommonly high polish, or incrusted with minute resplendent calcareous chrystals.

These casts have by some been referred to the *B. striatum,* figured by Lister, Angl. tab III, fig. 2.

In the size of these fossils there is great difference; we have seen some specimens, measuring eight inches from the tip to the base. It is remarkable thas these casts are almost universally discovered imbedded in the superincumbent stratum of red clay, and rarely in the limestone.

XXVI. *MUREX.*[*]—*An ovate or oblong spiral univalve, with rough, spinous, and projecting sutures, aperture ovate, ending in a straight canal or gutter, a little ascending.*

Shells resembling the *Murex erinaceus* of Linnæus, have been found in the limestone of Pickering. It is an excessively rough shell, with spinous processes—spires, six—it is much to be regretted that these fossils have hitherto been discovered in a mutilated state.

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[*] Lin. Syst. nat. 1216.

The *M. antiquus* of Linnæus, figured by Pennant, tab. LXXXI; by Lister, tab. III, fig. 1, and Montague, *Test. Brit.* has been met with in the quarries near Settrington—spires, eight—the first, large, ventricose, and produced; the remaining ones very prominent, and irregularly striated, so that upon the whole, the aspect is rugged.

The *M. Corneus* of Linnæus, occurs, also, in the same neighbourhood, mineralized. It is a narrow oblong shell, with eight striated spires. Length, three inches and one fourth.

The fossil shells from Ebberston of this genus, which have been considered to resemble the *M. Tubifer*, and *M. Tripterus* of Lamarck, occur in too imperfect a state to speak decidedly respecting them.

XXVII. *TROCHUS.**——*A subconical spiral univalve, with a transversely depressed, or rather quadrangular aperture—axis, oblique.*

The most common fossil shell of this genus is the *Trochus conulus.* It has a sharp apex, and a prominent line running along the spire. From the rocks on the north-sands, and the limestone quarries. The specimens from the aluminous shale are generally casts, and invested with pyritous chrystals. It is sometimes of a large size.

2. The *T. Umblicatus* is very common here—it is a small shell of a subconic form. From the rocks at the Nab. See Pennant, tab. LXXX, fig. 106.

3. A shell bearing the characters of the *T. Magus,* has been discovered in the quarries of Malton—it is in form subconical, with the ridges of the spires rising into well defined rounded tubercles. The base is striated irregularly.

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* Lin. Syst. nat. 1227. No. 326.

4. Shell in form resembling the former, but ever of a large size—with the spires a little protruding, and roughened by spirally—arranged transverse rugæ; the spathose matter representing the original, is uncommonly thick. From the aluminous rocks in the neighbourhood.

5. *T.* with a sharp apex, and nearly conical—the spires marked by regular rows of circular punctures, and rising toward the middle into a ridge a little acuminated—the base regularly striated and concave.

This fossil bears some resemblance to the *T. Convexus* of Parkinson,* the difference arising from the spires of the former being punctated, when in the latter they are spirally beaded. From the limestone of Malton and its vicinity.

6. Shell in form, conical—base, convex—the spires deeply striated spirally. The localities are the same as the preceding.

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* Org. Rem. vol. 3, p. 74.

XXVIII. *TURBO.**—*A spiral turretted univalve.—Aperture, round, complete, and toothless; the margins always disjoined in the upper part—the columella smooth at the base.*

A fossil shell is frequently discovered in the limestone of Malton, with five spires; the first, ventricose and spirally striated—in some respects it agrees with the *Turbo littoreus (Perriwinkle)* of Linnæus, but upon the whole, we are led to refer it to some unknown species.

As to the numerous and variously formed casts of taper shells of this genus, which occur in the limestone quarries of the district, and pyritaceous rocks of the neighbouring coast, it is impossible to speak decidedly respecting their proper species. Some of them have probably relation to some known shells as *T. Clathrus*, *T. Duplicatus*, and *T. Terebra.*

It is impossible in casts, or even in many instances in perfect specimens, to distinguish between the *helices* and *turbines*—the spiral casts above alluded to, have all of them round apertures; those with ovate and quadrangular apertures, are to be referred to other shells.

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* Lin. Syst. nat. 1232. No. 337.

XXIX. *DELPHINULA.—A subdiscoidal or slightly conical, spiral umblicated univalve.—Aperture, round.*

M. Lamarck* has separated this genus from the genus *Turbo* of Linnæus; in which he has placed those shells which have the edges of the aperture circularly united, and do not possess a disjunction of those edges near the columella, which is observable in the Turbines.

1. A discoidal compressed shell; volutions, four, with a sharp ridge running along the exterior rim of the spires, which are regularly and deeply striated spirally. From the limestone near Ganton-dale. A shell greatly resembling the above is figured by Parkinson,† pl. v, fig. 18.

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* Les Annales du Muséum d' Histoire Naturelle Tome. IV, p. 105.

† Org. Rem. vol. 3.

A large discoidal slightly umblicated shell, with wrinkled rounded spires. Occurs in the limestone of Appleton and Barton in the neighbourhood of Malton. Measures five inches in diameter. Casts of this description have the spires quite smooth.

XXX. *NERITA.*[*]—*A gibbous univalve, flattened at the bottom, and having no umbilicus.—Aperture, semiorbicular.*

In the limestone of Malton, a smooth shell with four spires, has sometimes been met with, which we refer to the *N. Pupa* of Linnæus; it is remarkable that many of the specimens though entirely constituted of calcareous spar, are marked on the spires by the parallel transverse black striæ, which are observable in the recent analogue. About the size of a Spanish nut.

The elegant fossil shell figured pl. II, fig. 3 and 4, bears the characters of this genus, but it appears different from any known species. The spires which are three in number, are marked transversely by numerous parallel waved ribs, which rise into well defined minute tubercles—so that at first sight the spires appear to be spirally tuberculated. From the limestone of Langton-Wold.

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[*] Lin. Syst. Nat. 1251. No. 329.

XXXI. *DENTALIUM.*[*]——*A straight or slightly bowed, tubular, conical univalve, open at both ends.*

The *D. Entalis* will sometimes be discovered in the alum-shale of Stowbrow; the testaceous part of the recent shell appears in these specimens to be completely disintegrated, so that on attempting to displace them, it will adhere to the fingers in the form of a dusty white powder, and this is the case also with many of the *Serpulites.* See the recent analogue in Lister's Conch. tab. CCCCLVII, fig. 2. Montagues Test. Brit. 494.

At Flamborough we have seen some siliceous casts which probably belong to this species.

Some specimens of a *Dentalite* analogous to the *D. Elephantinum* have been said to have occurred in the Whitby neighbourhood, but we have had no opportunity of examining them.

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[*] Lin. Syst. Nat. 1263.

The *Dentalite* with equidistant annular rugæ from Filey-bridge, Mr. Parkinson* is of opinion should be considered as *D. Annulatum*, it is difficult to obtain a perfect specimen of this fossil, from its extreme frangibility.

XXXII. *SERPULA*†—*A tubular, adherent univalve, which can scarcely be said to have any determinate form—but it is variously and fortuitously sinuous.*

The *S. Spirorbis* will frequently be seen in a mineralized state, adhering to the *Corallites* of Malton. It is a small wreathed shell, something similar to the *Cornu-Ammonis.*

*A Serpulite* of a conformation similar to the preceding, but with an extremely projecting sharp ridge at the margin of each side—from the yellow sandstone of the castle.

There is great variety in the form of these tubular univalves; sometimes they are nearly cylindrical, triangular, and if we are not deceived, quadrangular.

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* Org. Rem. vol. 3, p. 92.

† Lin. Syst. nat. 1264.

The triangular *Serpulæ* are designated *S. Triquetræ* by Linnæus. Also the various twisted and contorted forms they assume have given rise to the Linnæan species of *S. Intricata, S. Contortu-plicata, &c.*; all of which are to be met with in the district, either adhering to fossil shells, the *Ostracites* in particular, or imbedded in vast aggregated masses, in a compact greyish marble, which is generally susceptible of a good polish.

In the yellow sandstone and pyritaceous rocks of the north-sands, we have frequently seen the *Serpulite* figured by Parkinson, vol. III, pl. VII, fig. 8. "Its spiral turns (he observes) are placed partly one on the other, so as to form a nearly smooth convex upper, and concave under surface: the turns themselves being nearly round, and beset with slight longitudinal ridges —The last turn of this fossil is very much produced, and terminates in a round distinctly bordered aperture." See the figures of the different species of *Serpula* in Pennant, Lister, Da Costa, and Ellis. We have never discovered any of the *Serpulites* of this district possessing septa.

XXXIII. *SABELLA.**—*A tubular covering fabricated with sand and broken shells coherent by a gelatinous cement.*

A fossil every way coinciding with the *Sabella alveolata (Honeycomb)* of Linnæus, has occurred in the limestone of Malton, and sometimes in the rocks in this neighbourhood, or in scattered detached masses on the beach. It consists of numerous tubes placed parallel to each other, and containing frequent transverse septa.

Linnæus has noticed a similar fossil under the denomination of *Alveatus,* among his *Fossilia Petrifacta* Syst. nat. tom. III, p. 166, and which, though his description differs a little from the fossil under our consideration, yet he remarks *"videtur proxime accedere ad Sabellam alveolatam."* The recent analogue is figured by Pennant, Brit. Zool. tab. xcv, vol. 4, fig. 1; by Ellis, tab. xxxiv, p. 90.

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* Lin. Syst. nat. 1268.

XXXIV. *ECHINUS** *An animal of a roundish form, covered with a bone-like integument or crust, the surface of which is generally beset with tubercles, to which are articulated moveable spires of various forms and sizes—the mouth is always situated in the base of the shell—the vent (anus) which is the aperture through which the excrements pass, is situated variously, being more or less distant from the mouth; it is frequently covered by an operculum or lid, which in fossil subjects is not always to be discovered.*

In our examination of the organic remains of these interesting animals, we shall, as far as the number of species of the district allow, avail ourselves of the arrangement of M. Leske.

The entire genus is divided into three grand divisions, the *ANOCYSTI* having the vent in the vertex; the *CATOCYSTI* having the vent in some part of the base; the *PLEUROCYSTI* having the vent in some part of the side or superior surface, and this accords nearly with the Linnæan arrangement of *(regularis ano verticali) et (irregularis apertura*

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* Lin. Syst. nat. 1102.

*ani subtus ut os.)* And first, of the class of the echinites, which come under the denomination of the *Anocysti*, in which there are two divisions, *Cidaris (the turban)* and *Clypeus (the buckler.)*

The characters of the former are hemispherical or suboval; with porous ambulacra equally diverging on all sides from the vent, which is vertical to the mouth which is beneath in the base and central. The whole external surface of the fossil is decorated by tubercles or granulæ, arranged in most cases with the utmost exactness, so as to resemble the jewels or ornaments of an oriental turban—hence the name of the division.

We have not seen any fossil subject of this family that can properly be assigned either to the *Echinus esculentus*[*] of Linnæus, which is the *Cidaris miliaris* of the ingenious Klein, *Echinod,* 16 t. 9, or the *Cidaris saxatilis* of Leske, which is *Echinus saxatilis* of Lin.

The large *Echinites* of Malton are most probably referable to the *Cidaris hemispherica* rather than to any other.—It has ten biporous ambulacra dividing the whole surface into five greater and five less areæ—the exterior is beset with small tubercles, resembling *Millet-seeds*—hence Klein has placed these under the genus *miliaris*. These fossils bear great affinity to that figured by Dr. Plott, Nat. Hist. Oxfordshire, pl. v, fig. 5 The small *Echinites* of the north-sands are without doubt varieties of the preceding.

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[*] This species of the echinus (sea-hedgehog or sea-urchin) is often discovered lodged in cavities of the rocks, just within low-water mark, on the coast here.

The superb and highly perfect specimens of an *Echinite* from Malton, are to be considered as a variety of the *E. Diadema* of Lin., or *Cidaris Diadema* of Klein, who has placed this species of the *Echinus* under a genus he has called *Variolata*— The characters are a depressed hemisphere—the areæ, ten; the five larger have two rows of tubercles, which are of the greatest size in the region just above the margin, and which gradually decrease as they approach the vertex on the one side and the base on the other.

The five less areæ protrude beyond the larger, and are embellished by two rows of tubercles of a much smaller size, but following the same disposition as those of the larger. The tubercles are pierced in their apex, having the margin of the base crenulated. The remaining part of the surface is taken up by granulæ, which surround the bases of the tubercles in well defined rings. This *Echinite* answers to that figured by Parkinson, Org. Rem. vol. III, pl. I, fig. 4.

The component matter of these *Echinites* is a whitish compact carbonate of lime, frequently containing flint within.

On the Wold near Ganton, some specimens of those elegant fossils have been discovered, which Klein, from the formation of the tubercles, has placed under a genus he has named *Mammillata.* They appear to be a variety of the (*Cidaris mammillata mauri*) Moorish turban of Klein, *echinod.* 19, *t.* 4, *fig. A*, and the *Echinus Cidaris* of Linnæus.

The characters are, rather depressed; of a round circumference—the ambulacra are five, biporous and undulating, dividing the whole into five areæ, on which are disposed in alternate order, two rows of mammillæ, each of which is surmounted by a papilla perforated in the vertex, crenulated at the base and surrounded by a distinct groove. The remaining part of the area is filled up by miliary and obsolete granulæ. The component matter is silex.

A similar *Echinite* is figured by Parkinson, vol. III, pl. I, fig. 9,—by Dr. Plott, Oxfordshire, tab. V, fig. 3,—see also Rumphius, mus. t. XIV, fig. B, and Lhwydd, *Lithoph.* tab. XII, fig. 910.

The second grand division of the genus *Anocysti* is *Clypeus* (*the buckler.*) Of the *Echinites* of this family the *Echinites clypeatus maximus* of Lhwydd, Lithoph. Brit. 48, n. 971, t. 13, 971; or the *Echinus sinuatus* of Linnæus, occurs in the limestone of Malton.

The upper surface of this fossil is oblately hemispheroidal, and is divided into ten areæ, by ten broad striated ambulacra, which are broadest in the middle, and tapering both ways. One of the larger areæ is cleft by a deep groove passing from the vertex to the margin. The ambulacra, on leaving the vertex, diverge, and converge as they approximate the marginal region, and in that state proceeding to the mouth, in the form of five deep converging sulci. The base is slightly concave—the mouth is pentagonal and small.

The entire shell is thickly beset with granulæ, which are surrounded by circular risings. In some specimens the surface of the fossil is nearly smooth, being very slightly verrucated.

This fossil is the *Clypeus sinuatus* of Leske, and the *Polar stone* of Dr. Plott, p. 90, Nat. Hist. Oxfordshire, and figured by him, tab. II, fig. 9 & 10, see also Parkinson, Organ. Rem. vol. III, pl. II, fig. 1.

It has obtained the name of *Polar stone* from the vertices resembling the poles, and the ambulacra the meridian lines of a globe, when two of them are placed with their bases together. A specimen before us measures nearly four inches in diameter. The nucleus is composed of a fine greyish compact oölite—the shell is constituted of the carbonate of lime.

In the different specimens, the sinus will sometimes be deep, and sometimes but slightly indented.

The fossils of this species which have occurred in the immediate neighbourhood, are extremely small, rarely measuring an inch and a half in diameter—we are at a loss whether to consider them the young shells or a variety of the species; they are very common in the rocks on the north-sands—on Filey-bridge, and in the neighbouring limestone.

In the abovementioned places an *Echinite* frequently will be seen, the characters of which are the same as the preceding, save only in the ambulacra, which instead of being striated are formed by a row of pores and striæ, leaving a small space between them; so that the whole of the superior part may be considered to be divided into twenty areæ, by twenty ambulacra—this may probably be making too nice a division—it is obviated by considering each ambulacrum to be composed of a row of pores and striæ.

The second grand division of the *Echinite*, as was before observed, is the *CATOCYSTI*, the *(anus)* vent of which, is in some part of the base of the shell. Klein with his usual accuracy has divided this family (*Catocysti*) into *Fibulæ (buttons) Cassides (helmets)* and other *genera*, which as they have not occurred in our district, we shall not enumerate them—he has subdivided the *Fibulæ* into *Conuli* and *discoides*, and the *Cassides* into *Galeæ* and *Galeolæ*.

The *Conulus albogalerus* of Leske, the *Echinus albogalerus* of Linnæus, so named from the resemblance which *Echini* of this genus bear to the *white pointed caps* * of the priests of the sun, is the only species of the *Fibulæ* that has occurred.

The base is pentagonal, the sides rising from it and forming a blunted pyramid, down the rounded angles of which pass the ambulacra, consisting of two rows of pores, and dividing the whole into five greater and five less areæ.

The mouth is small, circular, and centrally situated—the *(anus)* vent is situated nearly in the margin, and is ovate—the ambulacra do not meet at the margin, but converge to the mouth—the superior part is sprinkled with nearly obsolete granulæ, which at the base appear to have a tendency toward a concentric arrangement.

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* See Mountfaucon L' Antiquité expliquée in the supplement on the Gods of Ægypt, vol. II, book 7, pl. 50.

The most complete specimens have hitherto been met with in the quarries of Appleton and Barton, composed of a pure whitish carbonate of lime; the nucleus is roe-stone—at Rillington, the nucleus is chalk. Some casts composed of black flint, have occurred on the beach here, and at Flamborough. The recent analogue of the fossil subject is not known.

In the abovementioned places exists an *Echinite* with ambulacra, possessing a single row only of pores, but agreeing with the preceding; in other respects this may be considered a variety of it. Parkinson has correctly figured this species in vol. 3, pl. II, fig. 10, 11, Org. Rem.

The *Cassides (helmet-stones)* form, according to Klein, the second section of the *Catocysti;* these *Echinites* have been thus designated from the sides, which rise toward one extremity of an ovate base into a vaulted form, resembling the front of a helmet.

The *Echinocorys scutatus* of Klein, tab. xv, fig. A. B. is the only species which has been hitherto discovered in the district.

The ambulacra are biporous, dividing the whole shell into five larger and five less areæ. The base is oval and slightly concave, the margin is a little rounded; in the middle of the base is a prominent slip, extending from the mouth to the vent, the former of which is placed at the broadest extreme of the base; the latter near the galeated protuberance, which causes the base to be narrower at that point. On each side of the elevated slip are two distinct rows of granulæ, which are also scattered over the upper surface of the shell.

This *Echinite* has hitherto occurred on Langton-Wold; the nucleus is sometimes siliceous. It is correctly figured by Parkinson, Org. Rem. vol. 3, pl. 11, fig. 4.

The third grand division of the *Echini* is the *Pleurocysti*, in which the vent is in some part of the side.

A species of the *Cor marinum (sea-heart)* belonging to the family of the *Spatangi* of Leske, is sometimes discovered in the chalk-rock of Flamborough; fossils of a similar description are figured by Lhwydd, *Lithoph.* fig. 964, 967.

The characters are cordated and oblong, gibbous at one end, and marked by a deep sulcus on the other. The base is slightly convex and granulated, which is also the case with the superior surface—the ambulacra are five in number, composed of four rows of pores joined by transverse striæ, and situated in as many grooves, dividing the shell into five areæ; each two rows of the pores uniting at the extremities of the grooves.

The two shortest ambulacra tend in an oblique direction to the narrow end; two others, which are longer, to the broad end, the remaining one forming the sulcus, passes to the mouth in a direct line. A galeated ridge in the middle of the side opposite to that containing the sulcus, passes directly to the vent which is situated in its superior margin. The vent is nearly circular—the mouth is reniform—the upper lip extending over the lower—the vertex is perforated by four large pores, which are not always visible in the fossil subject.

The *Spatangites ovalis* of Leske, pl. XLI, fig. 5, has occurred at the same place as the preceding. The base is elliptical—the ambulacra, which consist of a double row of pores, are five in number—three of these ambulacra diverge from a point near to the vertex; the middle one passing directly toward the mouth, the other two pursuing an oblique direction—at the distance of nearly half an inch, the remaining two ambulacra diverge, having the vent between them; the two points of divergency are connected by the extension of the middle ambulacrum of the anterior three. Few specimens have been met with.

XXXV. *SPINES of ECHINI.*—These are rarely to be discovered in a state of attachment to the shell of the fossil subject,* and this is not to be wondered at, when we consider the various changes which must be incident to the *Echini,* previously to their petrifaction—and it is further remarkable, that in those places where fossil spines are the most numerous, we have scarcely ever met with a trace of the *Echinite,* and *vicé versa.*

It is but of late years, that many of the fossils now considered as the mineralized remains of the spines of the *Echinus* were known as such; from the fortunate circumstance, however, of their having been discovered in a state of adhesion to the shell, all difficulty respecting them must be done away; and we have not only the satisfaction of determining their origin, but the particular family of the *Echinus* to which they have once severally belonged—in illustration of this we refer the reader to the elegant plates in the third volume of Mr. Parkinson's Org. Rem. where he has presented us with many most interesting specimens of the *Echini*, in a state of mineralization, with the spines in attachment to the shell—the ingenious foreign authors, who have treated on and figured the different species and varieties, are worthy of our attention; as, M. De Luc, *in his travels;* Bayer, *Oryct. Noric;* Müller, *Delic. Natur.;* Aldrovandus, *Mus.;* Volkmann, *Siles. Subt.;* Klein, *de Acul. Echin. et descriptiones tubul. marin.;* Wagner; Phelsum, &c.

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* We have heard of a siliceous echinite which was said to have been found on the shore near Whitby, with the spines adherent; if this were the case, we have no hesitation in pronouncing it unique.

The fossil spines which have occurred in this neighbourhood, belong to the class *CLAVICULA*, which is divided into two species, the *Glandaria* from their similarity to the acorn, and the *Cucumerinæ* from their resemblance to the cucumber.

To the first species belong those remarkable fossils from the limestone of Malton, which have long been considered as *Lapides Judaici*, petrified olives; Volkmann, Siles. Subt. 1, tab. 27, fig. 32.—Aldrovandus, Mus. 711. Linnæus was in doubt respecting their real origin, yet he observes at the same time that "some supposed them to have been the spines of the *Echinus*, and indeed the base bears them out in the conjecture, but I know not any *Echinus* to which they can be referred."

M. De Luc, however, discovered a spine of the above description adhering to a fragment of the shell of an *Echinite*, and Mr. Parkinson has figured a specimen of a similar kind, from Kent, pl. IV, fig. 21.

In form, these fossils somewhat approximate to that of an olive—the exterior is beset with pretty regular rows of granulæ—the base exhibits a circular perforation, showing the point of articulation; the component matter is universally a hard compact carbonate of lime, of a yellowish tinge. See a specimen from Malton, figured, pl. II, fig. 5.

The second species of *Clavated Spines* is the *Cucumerine*. They preserve the form indicated by the name of the species; the exterior is beset with well defined rows of granulæ, which rise from slightly elevated ridges traversing the fossil longitudinally—the extreme, toward the base, becomes nearly cylindrical, and shows distinctly the circular articulating perforation. The component matter is the same as the preceding, but so extremely fragile, that an entire spine has rarely been obtained—they are common in the limestone of Malton. See the specimen figured, pl. II, fig. 6.

It is to the labours of Klein that we are indebted for being able to throw some light upon the fossils of Speeton, which have generally been considered *Belemnites*.

It was his opinion that those fossils which possess the conical concamerated testaceous body, the conical cavity, and the canicula, should remain among the *Belemnites*; and that those, which like the *Belemnite* are composed of radiating spathose matter concentrically arranged, but wanting the other requisites of that fossil, should be esteemed Echinital Spines. *Descrip. Tubul. marin.*

The Speeton fossils abovementioned are acuminated at both ends, and tumid in the middle, composed of an amber-yellow, translucent, spathose matter—on breaking them, radiating striæ are observable, centring in a longitudinal line passing nearly through the midst of the fossil—not a trace is to be seen of the canicula, the conical cavity, or testaceous body—besides, what must be considered as greatly favouring the supposition of their relation to the *Echinus*, we have invariably observed, when the specimen was perfect, a small cylindrical projection, fitting exactly to the perforated papillæ of some of the species of the *Echinus*. Bayer has figured a fossil of this description, tab. 1, fig. 7, *Oryct. Noric.*—but he considers it a *Belemnite.* The length of these fossils exceeds three inches.

The curious acicular bodies discovered imbedded in masses of a greenish, and sometimes reddish compact limestone, which are strown on the beach here, are certainly referable to the *Echinus*. The texture and nature of the constituent matter is precisely the same as the foregoing—but it is sometimes hydrophanous. The form is cylindrical, terminating in a sharp point, and of the thickness of a common knitting needle—we have seen some specimens upward of four inches in length.

Whether the *Tube-agate** owes its markings and peculiar structure to the acicular spines of the *Echinus,* is still a matter of doubt—it is possible that these aciculæ, in some instances, might have been envelloped by the fossil forming agate, and have resisted impregnation, and decayed at a posterior period—some specimens favour this supposition.

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* Minerals, p. 30.

# Part Third.

# FOSSIL ZOOPHYTES.

# FOSSIL ZOOPHYTES.

According to the plan generally pursued in the preceding pages, we shall adopt the Linnæan arrangement of the Zoophytes, availing ourselves at the same time of the labours of Peysonell, Ellis and Solander, Woodward, Parkinson, and others, who have treated on the recent and mineralized subjects belonging to that interesting division of the system of nature.

I. The *TUBIPORITES* (the organic remains of the tubipores) are the first genus we propose to examine: they consist of an indefinite number of cylindrical, hollow, erect, parallel tubes—the tubes are connected, for the most part, by tubular ramifications, rarely by dissepiments or plates.

The mode of junction and the internal structure of the tubes form, in most instances, the distinguishing characteristics of the different species.

These fossils have chiefly a calcareous, or an argillaceous basis; sometimes it is siliceous—we have seen all the three earths enter into the composition.

The chalcedonic and agatized specimens of the tubiporite, are truly elegant fossils; the colour of these is commonly yellowish or reddish, translucent and susceptible of a good polish, distinctly displaying the corrallite, which is ever of a deeper shade than the surrounding matrix.

The tubes, however, do not always partake of the nature of the base, but are often siliceous when it is calcareous or argillaceous. When the matrix is constituted of matter liable to decomposition, and the tubiporite is siliceous, we have an excellent opportunity of discovering its peculiar structure—

in calcareous matrices the same effect is produced, by frequently immersing the specimen in the marine or nitric acids.

The tubiporite, is by no means so common a fossil in this district, as the madreporite; and care ought to be taken not to confound them; for, in some instances, the internal radiated, or more properly laminated structure of the madreporite, is so completely destroyed, that the specimen is to all appearance a tubiporite; and this is particularly exemplified in the limestone of Seamer—the best method, when any doubt arises respecting the real nature of the specimen, is to make different sections; and in all probability the laminated structure of the madreporean star will be detected.

1. *TUBIPORA MUSICA.*[*]—*Red organ-pipe coral* of Ellis and Solander.[†] *Tubularia purpurea* of Tournfort,[‡] Pallas,[§] and others.

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[*] Lin. Syst. nat. 1270.

[†] The Natural History of many curious and uncommon Zoophytes, collected from various parts of the Globe—by John Ellis, Esq., F. R. S. and Daniel Solander, M. D. F. R. S. &c., pp. 143, 144, tab. XXVII.

[‡] Institut. t. 342.

[§] Zooph. 199.

This tubiporite is described by Linnæus, as consisting of a fasciculus of tubes, combined by distant, transverse membranous dissepiments or plates.

The fossil we are about to describe, differs essentially from the recent coralline. The absence of the membranous plates, the smoothness, and radiating joints of the tubes of the *Red organ-pipe coral* of Ellis, are sufficient reasons for considering the fossil subject a different species at least; in other respects, however, the resemblance is close, and particularly so in the internal pipes, which dilate and contract much after the same manner, and in the lateral horizontal connection between the tubes; but this connection is by no means continuous, nor does it seem to follow any regular order.

We define this tubiporite, therefore, to be a *fasciculus of parallel, erect, scabrous tubes, faintly striated longitudinally, containing others, which, by radiating horizontally, connect the whole.*

The matrix is generally a greyish compact limestone, which is sometimes so much disintegrated, that the construction of the corallite is very apparent, and especially so, when the tubes are siliceous;

it is sometimes a blackish marble, the imbedded tubiporite being transmuted into a white spathose substance—the polished slabs of this description display the internal structure with great effect.

A specimen before us containing a considerable proportion of argill, is not only tinged throughout by a deep purple, but the tubes, also, retain that colour in a high degree. This tubiporite is the most common species the district affords—it is to be found in small detached masses on the beach—it is delineated by Parkinson, *Org. Rem.* vol. 2, pl. 1, fig. 1.

2. A tubiporite with diverging, straight, parallel and extremely scabrous, hollow tubes, connected by horizontal ones of a much less diameter, has sometimes been discovered imbedded in the calcareous and argillaceous masses on the coast—the colour of the marble containing these remains is various, as bluish, greyish, blackish, greenish, &c., which latter shade arises from the presence of the sulphuret of iron; the tubes are either siliceous, or composed of and filled with a whitish spathose

matter. This tubiporite agrees in all its characters with the *Tubipora strues* of Linnæus.*

The specimen delineated pl. IV, fig. 1, was found on the beach to the north of the castle; the tubes being siliceous, and the constituent matter of the base a loose greyish limestone, which had suffered from weathering, the peculiar construction of the tubiporite is rendered very evident; the divergency of the tubes is considerable; and the connecting horizontal ones by their length, form a distinguishing feature.—A similar fossil is described by Woodward.†

3. A tubiporite composed of a fasciculus of simple hollow tubes, uniting with each other by means of lateral ramifications not preserving any particular angle. The matrix of this corallite is generally a greyish limestone. The tubes are for the most part, composed of spathose matter, and filled with the same—the polished sections display the ramifications very satisfactorily; we have seen

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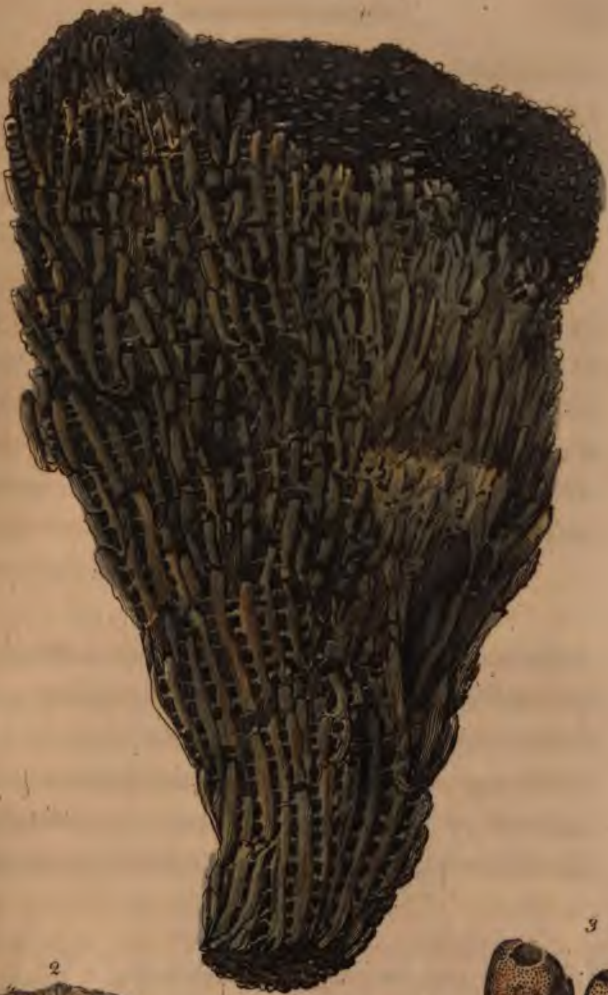
* Syst. nat. 3755.

† An attempt towards a Natural History of the Fossils of England, in a Catalogue of the Fossils in the collection of J. Woodward, M. D. vol. 1, p. 130.

late IV

1



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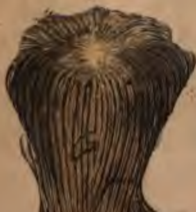

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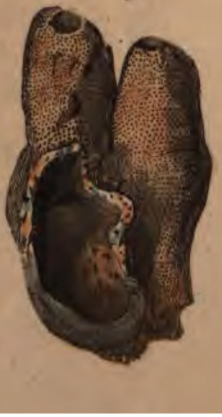

these remains imbedded, also, in a reddish argillaceous iron-stone. This species, Mr. Parkinson is of opinion, might properly be termed *tubipora ramulosa.* See pl. III, fig. 1, of vol. II, of the same author.

4. *TUBIPORA CATENULATA* (*chain coral*) of Linnæus.[*] The elegant and curious formation of this zoophyte, which is known to exist only in a fossil state, has long been the subject of admiration among oryctologists. Bromell,[†] Fougt,[‡] Buttner,[§] Volkmann,[‖] and Parkinson,[‡‡] have respectively delineated and described it.

The equal, parallel, ovate, erect, filiformed tubes, being joined by their sides, form erect folds; the superior, and sometimes the inferior margins of which, as might naturally be expected, assume the appearance of a small chain; the folds by frequent contortions, which anastomosize, form a retiform plexus, which Bromell has assimulated to that of the *lymphatic vessels.*

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[*] Syst. nat. 1270.

[†] Lithograph. Spec. 2, 25. tab. XXV.

[‡] Amænit. Acad. tom. I, p. 103, tab. IV, fig. 20.

[§] Corallograph. tab. I, fig. 2.

[‖] Silesia Subterranea, tab. XX, fig. 3.

[‡‡] Org. Rem. vol. 2, pl. III, fig. 4, 5, 6.

But few specimens have hitherto occurred—those we have seen have been imbedded in small rolled pieces, of a compact black marble, with grains of resplendent pyrites interspersed, or in a granular mixture composed of argill and silex—in the former instances, the corallite is composed of a white spathose matter, which exhibits the catenated formation with great effect.—From the neighbouring shores.

II. *MADREPORITES,* are the mineralized remains of the madrepores, under which genus Linnæus[*] has placed all those corals which possess a stony fulciment, and have their cells divided by lamellæ, disposed in a *stellular form.*

Imperatus, Peysonell, Rumphius, Donati, Ellis, and Shaw, have all of them shewn that the madreporean corals belong to the animal kingdom.

Dr. Donati[†] has described and delineated the animal, forming a species of the genus madrepora, which is copied by Ellis,[*] and Parkinson.[†]

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[*] Syst. nat. 1272. No. 337.

[†] Philosoph. Trans. vol. 47, pp. 105, 106, tab. IV.

The *madreporæ simplices stella unica,* or those madrepores possessing one star, are the first species which the Linnæan arrangement presents us with.

The *Madrepora turbinata,* or top-like madrepore, is by no means uncommon in a fossil state, in the district; the quarries of Malton, and the adjacent shores, have furnished many curious specimens.

The characters are inversely conical, small at the base, and increasing upward—smooth—the star, hemispherically concave. The lamellæ, forming the star, are said to be sometimes denticulated, but this we have never been able to discover in any of our specimens—indeed it is to be lamented that the stellular cavity is, in by far the greater number of instances, filled by the limestone containing them, so that it is impossible to determine the peculiar characters.

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[*] Nat. Hist. of Zoophytes, tab. XXXII.

[†] Organ. Rem. pl. II, fig. 2, 3, 4.

Fougt* has figured several species of this madrepore, as well as Hellwing,† Pallas,‡ Bromell,§ and the author of the *Dissertation on the Corals of the Baltic*.

The form of these fossils admits of various modifications, sometimes expanding gradually from a truncated, or pointed base, forming a pretty regular cone; sometimes so suddenly, that the inferior surface is nearly discoidal; sometimes prolonged into a cylindrical body, or expanding at the stellated extremity like a *speaking-trumpet;* sometimes assuming a shape, exactly resembling the horn of a ram.

However diversified the external shape may be, we do not imagine that it would justify the dividing those that do so differ, into distinct species, since it evidently depends upon the continuance, or cessation of the labours of the polype forming the madrepore, and the particular direction given to them by some fortuitous cause.

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* Amænitat. Acad. tom. I. p. 87, tab. IV. fig. 1, 2, 3, 5, 7.

† Lithographia Angerburgica, tab. v. fig. 9, 10, 13, 15.

‡ Zooph. 176.

§ Lithograph. tab. 36, 38, &c.

The lamellæ, also, forming the concave stellated surface, are variously disposed; we have seen them with a few waved simple radii, passing from the centre of the cavity, to the margin—with innumerable filiformed waved radii, diverging from the same centre—with the radii slightly waved, dividing the stellated surface into four quarters, the radii of each quarter diverging from a different centre—this, Mr. Parkinson observes; yields the appearance of a flower, with four expanded petals—with radii extremely broad at the margin, gradually tapering till they become filiform, and terminating at a circular inclosure, the diameter of which, is one third of the whole disk—with radii similar to the preceding, alternating with others of an eighth of the same length; of this description is the surface of those cylindrical simple madreporites of Malton, measuring upward of two inches in diameter, and sometimes five inches in length, without deviating from the cylinder—with radii which dichotomize, and proceed to a central circular inclosure—with radii which dichotomize, and proceed to a circular inclosure, beautifully reticulated; this last variety is from Malton, and is frequently tinged with a deep cherry-red; whether this be adventitious, or naturally belonging to the coral, in a recent state, has not been determined.

The inferior side of these corallites has primarily been invested with a thin, smooth, longitudinally striated cuticle, the remains of which are sometimes discernable—in general, however, the exterior of this side exhibits longitudinal striæ, answering to the edges of the lamellæ, forming the madreporean star; these striæ are frequently intersected, and elevated by annular swellings, denoting the different increments of growth; tubercles and wart-like excrescences are very common on the inferior surface.

It appears that the recent analogue of the fossil has fastened itself to other bodies by a pedicle, formed either by tubular ramifications, or by the lateral extension of the cuticle and lamellæ. See the specimen from Malton, figured pl. IV, fig. 2, in which the pedicle is very distinct. See also the specimens delineated by Parkinson, vol. II, pl. IV, fig. 1, 2, 3, 4, 13, 14, 15, 16, 17.

The component matter of the Malton fossils is universally a whitish, or greyish, or yellowish brown compact carbonate of lime, sometimes tinged with cherry-red—that of those of the coast is a compound of calcareous and argillaceous earth, into which silex insinuates itself. Agatized and chalcedonic specimens are rare.

In the size of these corallites there is considerable difference—varying from half an inch, to three inches at the broadest extreme, and from an inch, to five inches in length.

The convex stellular surfaces formed by the impression of the concave one, of the turbinated madreporites, are some of them highly interesting; care, however, ought to be taken, not to confound these with other species of single starred corallites, as this stellated appearance is but superficial; the true nature of the specimen will be best discovered by penetrating into the substance of the fossil.

The specimen delineated pl. III, fig. 1, 2, 3, bears the exact form of a ram's horn—the translucency and colour of the spathose matter yielding an appearance very similar to horn. Fig. 1, of the above plate, shows the cuticle enveloping the longitudinal edges of the lamellæ, which is regularly striated lengthways by striæ, which would be straight, were it not for the numerous annular swellings arising from the different stages of the labours of the polypean artist—what adds materially to the beauty and curiosity of this specimen, is the appearance of a second coral germinating from the disk of the first.

Fig. 2, is a view of the other side of this fossil, exhibiting the remarkable sinuosities of the edges of the lamellæ, the cuticle being removed.

The same figure shews the polished transverse section of the second corallite—the radii are uncommonly sinuous, and their tenuity is extreme. Fig. 3, is the concave stellated surface of the same.

We have never detected in the fossils of this kind any remains, whatever, of the pedicle, this we attribute to bouldering, as these fossils have hitherto been discovered loose, and scattered on the shore.

It appears from the corallite before us, that the labours of the animal were at first much contracted, that by successive exertions he had expanded his mansion, still retaining its pristine compressed conical form, and at the same time gradually twisting it into the exact shape of the horn of a ram; that having arrived at a certain stage, he had desisted, begun anew his labours on a narrower scale, and in all probability, had he been permitted to proceed, he would have reared a second fabric similar to the first.

*Madrepora porpita (shirt-button madrepore)* Linnæi, Syst. Nat. 1272, No. 7. A simple madrepore without a pedicle—star, convex at the margin, but hollowed out toward the middle. The inferior surface, which is nearly smooth, is marked by perpendicular striæ, which are traversed by slight annular swellings—the form is orbicular.

The organic remains coinciding with the above characters, have by some naturalists, been considered as the *seeds* of madrepores, by others, the *operculum* or *lid*, or the *impression* of the stellated surface of the *madrepora turbinata.*

Bromell[*] and Buttner[†] have designated and considered them, *Fungi marini capitula,* the heads of some marine fungus; Scheuchzer, *Lithographica Helvetica;* Fougt, *Amœnitat. Acad.;* and, Lhwydd, *Lithograph.* have figured and described several species.

Linnæus, from the invariable absence of the pedicle, has considered that circumstance as a distinguishing character of the porpital species.

Some few specimens of these madreporites have been met with in the limestone of Malton, constituted entirely of calcareous spar, and on the shore here, composed of a yellowish or reddish chalcedony.

*Madrepora areola.*[‡] Some varieties of this species occur mineralized, in the limestone of Langton-wold, but the stellated surface has ever been so much covered by the matrix, that the more elevated parts of the meandring ambulacra have only been visible—the interstices being filled with calcareous spar, so intimately blended with the matter now representing the coral, that we have not been able to remove it. See a recent coral of this kind delineated, tab. XLVII, fig. 4, in Ellis' and Solander's *Nat. Hist. Zooph.*

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[*] Bromellii, Lithograph. p. 53.

[†] Corallograph. p. 24, tab. III, fig. 5.

[‡] Lin. Syst. Nat. 1274, No. 12.

*Madrepora cyathus.* On inspecting several mutilated fragments of a corallite, from the neighbourhood of Pickering, we are led to imagine that either this coral, or some variety of it, does exist in a state of mineralization.

In some of the fragments above alluded to, the alternating long and short radii are tolerably preserved, together with the cyathiformed shape of the recent coral, depicted and described by Ellis,[*] Plancus,[†] and Marsigli.[‡]

From the circumstance of not being able to examine the concave stellated surface, which hitherto has been either wanting or filled with the limestone, it has been impossible to count the number of the lamellæ of the fossil subject, which are eighty in the recent coral.

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[*] Nat. Hist. Zooph. p. 150, tab. XXVIII, fig. 7.

[†] Plancus de conch. p. 128, tab. XXVIII, app. fig. M, Ed. 2.

[‡] Histoire Physique de la Mer, par Louis Ferdinand Comte de Marsigli, p. 153, tab. XXVIII, fig. 128, No. 11.

### Of *MADREPORITES with many distinct stars aggregated together.*

To determine with any degree of accuracy, the precise species to which several of the fossil madrepores we shall have to examine belong, would be impossible—the multilated state of the specimen, arising either from bouldering, or the inward decay, or dislocation of the lamellæ and parietes; the intimate union between the corallite and the limestone, or other extraneous matter, which in many instances completely envelopes the exterior, and consequently prevents the examining of the peculiar features of the surface of the stars, which alone in some cases determines the species; the mixture of several species thrown together in one mass, all add to the difficulty; under such circumstances then, we must have recourse to analogy, and the different sections of the corallite—many madreporites, however, differ essentially from any known species.

*Madrepora favosa*[*] An aggregated, conglomerate, madrepore, with broad, angular, concave stars, composed of serrated, connate, lamellæ.

From the attentive examination of a variety of specimens of madreporites from Malton, we have no doubt, whatever, of the existence of this coral, in a state of mineralization; in some we have detected the denticulated lamellæ, laterally uniting.

The figure given of this fossil by Fougt, *Amœnitat. Acad.* tom. I, tab. IV, fig. 7, seems to represent a madreporite much injured, and which resembles rather, the *Madrepora abdita,* of Ellis, who observes, that it is probably a variety of the *M. favosa.—Nat. Hist. Zooph. p.* 162, *tab.* L, *fig.* 1, 2.

The external form of these madrepores is oblately hemispheroidal; composed of a deep reddish brown calcareous spar; internally, they are sometimes hollow, having the cavity lined with cuneiformed calcareous or microscopic quartzose chrystals.

It is a remarkable circumstance, that in the vicinity of Malton, many madrepores, not in a state of mineralization only, but little differing from recent corals, should be discovered disengaged from the limestone, and imbedded in the loose ferruginous clay, composing the incumbent stratum.

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[*] Lin. Syst. Nat. 1275, No. 14.

In some mineralized specimens, the superior stellated surface is entirely free from any adventitious envelopement, in others it is covered by a kind of stalagmitic film, which will easily be removed, by immersion in marine acid and the assistance of a graver—supposing the recent analogues of these madreporites existed in the neighbouring ocean, their occurrence so far inland, must be a subject of admiration—it is well-known no such corals belong to our seas, but inhabit the waters of the remotest corners of the globe.

*Madrepora Ananas.* An aggregated madrepore, composed of annular, convex, unequal, multiradiated stars, concave at the disk.

In the limestone quarries, and on the neighbouring shores, we frequently have met with madreporites, possessing the identical characters of the *M. Ananas* of Linnæus* and Ellis.†

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* Syst. Nat. 1275, No. 15.

† Nat. Hist. of Zoophytes, p. 168, tab. XLVII, No. 64.

It must be confessed, that the specimens from the beach have their exterior surfaces smoothed by bouldering in most instances; yet the transverse sections exhibit the peculiar hexagonal and pentagonal arrangement of the parietes, bearing a great resemblance to the cells of the *honey-comb;* the interior of each figure is elegantly marked by numerous radii, proceeding from a minute central spot, which is enclosed by a ring, having a diameter upward of one third of that of the containing figure.

The component matter is generally a translucent marble, of a whitish, reddish, greyish, or blackish colour, and susceptible of a good polish—or a highly translucent agate, or chalcedony of a bluish, yellowish, or reddish colour—specimens of this kind are the most elegant fossils of the district.

The Malton specimens of this corallite, display the external conformation of the stars, which agrees precisely with that of the recent coral—the shape is nearly hemispheroidal.

Volkmann, Bromell, Fougt, and Helwing have figured this fossil. Helwing's[*] specimen seems to have suffered from attrition.

*Madrepora galaxea.* An aggregated madrepore, with tolerably crowded and slightly concave stars; the lamellæ are very thin and indistinct toward the axis—with plain, thick parietes.

The stellated surfaces of some of the madreporites from Malton, originate from the markings of this coral—the lamellæ forming the star, are of extreme tenuity, and of different lengths; four of them diverging from the centre, with three others much abbreviated, and inserted between each, toward the extreme, and of course not diverging from the centre.

This peculiar structure of the star is noticed by Ellis,[†] who has delineated this madrepore.[‡] In the depression of the star, in the parietes, and in all other respects, except the external shape, the madreporite coincides with the madrepore—that of the former being much more convex than that of the latter.

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[*] Lithograph. Angerburg. tom. I, tab. IV, fig. 8, 9, p. 29.

[†] Nat. Hist. of Zooph. p. 168.

[‡] Tab. XLVII, fig. 7.

The constituting substance, is an extremely hard, compact, and slightly translucent greyish, or brownish marble.

*Madrepora pleiades.* An aggregated madrepore, with nearly round stars, with acute elevated margins—interstices, smooth and concave.

A madreporite before us, from the limestone of Pickering, coincides in every respect with this coral—the component matter is a whitish carbonate of lime, which has much the appearance of a recent madrepore. See Ellis, *Zooph. tab.* *LIV*, *fig.* 7, 8.

*Madrepora annularis.* An aggregated madrepore, with round, equal stars, elevated at their margins—with plano-concave radiated interstices.

The recent coral is figured by Ellis and Solander, *tab.* *LIII*, *fig.* 1, 2, from which the limestone specimens do not differ in the least—the stars in many instances being disengaged from the matrix, are very distinct, the radiated interstices are equally so.

The external shape is convex and globose, the inferior part being somewhat turbinated, exhibiting the lamellæ in a lateral view, which seem to diverge from a common centre.

The madreporite figured by Parkinson, *Org. Rem. vol. II, pl. V. fig.* 4, bears but a slight resemblance to the recent analogue.

*Madrepora radiata.* An aggregated madrepore, formed by cylindrical stars, elevated at the margin, with broad concavely sulcated, and radiated interstices.

The madreporite we refer to this species, has hitherto occurred in rolled masses on the beach here, generally composed of a deep reddish combination of argillaceous and calcareous matter.

The conformation of the stars and their size, agree with the *m radiata* of Ellis and Solander, *tab. XLVII, fig.* 8; but we have never been able to detect any radiation whatever on the interstices—the specimens, indeed, have suffered much from attrition and decay. Parkinson * and Sowerby † have delineated fossils, which have resemblance to the coral in question.

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* Organ. Rem. vol. II, pl. V, fig. 8.

† Brit. Min. vol. III, tab. CCLXXXIV, upper figure.

*Madrepora faveolata.* An aggregated madrepore, with subangular, many-radiated stars—with parietes not always of the same thickness.

In the red clay stratum of Malton, a madreporite has been met with, which though it is highly tinged by the ferruginous oxide, yet seems to be uncommonly free from other extraneous impregnation; the conformation of the stars coincides with that of the *m. faveolata,* of Ellis and Solander, rather than any recent coral with which we are acquainted. *Nat. Hist. Zooph. tab. LIII, fig.* 5, 6.

Specimens of this description are generally porous, light, and frequently perforated by the *mytilus lithophagus,*[*] which is often discovered in the interior of the corallite, in a state of mineralization.

*Madrepora arachnoides.* This is a most singularly interesting fossil: the exterior surface is either variously undulating, or regularly mammillated, the whole of which is enriched by crowded small smooth stars, with waved filamentous radii, laterally uniting with each other, so that the entire surface is covered by radiations.

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[*] Fossil Conchology, p. 121, No. 4.

There is a considerable difference in the formation of the stars, as are sometimes very nearly smooth, or but little elevated in the centre, sometimes a little centrally impressed.

Bertrand, in his *Dictionaire Universel des Fossiles,* conceives that those fossils having their surfaces marked by elevated stellated risings, are not the organic remains of the corals themselves, but the casts or impressions of them, which were formed when the matrix was in a soft state.

Of the truth of the foregoing observation there can be no question; but we have remarked, that upon splitting numerous masses of the limestone, in which the corallite is imbedded, we have obtained two fragments; the one, with slightly elevated multiradiated stellations; the other, with similar radiations, but slightly depressed; the markings of the latter are invariably superficial, whilst those of the former sink into the limestone; from which we infer, that the concavely radiated stars of this species are the casts of those similarly radiated, in relief.

This fossil has obtained the name *arachnoides,* from a supposed resemblance which the stars have to the web of a spider; it has also been designated *rosenstein,* from some fancied assimulation of the radii to a flower; and *cometstein,* from their being something like the luminous nebula which the tail of a comet sometimes assumes. Volkmann has delineated this fossil in his *Silesia Subterranea, tab. XVIII, fig.* 11, and Scheuchzer also, in the *Lithographia Helvetica, fig.* 54.

Fragments of a coarse brownish limestone, interspersed with specks, and traversed by veins of calcareous spar of many feet in length, will be seen entirely covered with this fossil, in almost all the neighbouring quarries, and those of Ayton in particular; at Malton also, this fossil is very common.

A madreporite with considerably elevated large stars. with prolonged, and somewhat waved radii, which unite with those of the adjacent stars—the above characters agree with those of the *m. arachnoides,* if we except the size and protuberance of the stellated markings—there is a circumstance, however, which adds greatly to the singularity of this fossil, the regular arrangement of the stars: they are not variously scattered, but are disposed in meandering rows, and in some instances so closely, as to appear like one continued ridge—the rows are distant half an inch from each other, the intermediate roundly sulcated space, being crossed by the innumerable waved radii of the stars—on the detritus of the conoid summits of the stellations, this fossil yields an appearance, very similar to that of some of the conglomerated madrepores.

The *madrepora undulata,* of Parkinson,[*] seems to have had some relation to this corallite; but he refers it rather to the *madrepora vermicularis;* "the difference, he observes, appearing chiefly to consist in the magnitude of the *m. undulata,* exceeding that of the *m. vermicularis.*"

In the madreporite we allude to, there is no trace whatever of the bifurcated, and unequal radii of the *madrepora vermicularis;* but radii, as was above observed, the complete counterpart of those of the *m. arachnoides.*

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[*] Organ. Rem. vol. II, p. 36.

In some detached masses of a tolerably compact limestone, of a brownish or yellowish colour, which have been found near Hackness, we have discovered stellated configurations, not dissimilar to those of the *m. vermicularis*—the external surface is completely obliterated; but the sections present us with crowded, large stars, composed of unequal waved radii, which dichotomize—the stone is susceptible of a slight polish—it requires a lens to come at the real characters of the corallite.

Volkmann [*] has figured this fossil; but we refer the reader to Mr. Parkinson's correct figure, *Org. Rem. pl.* *VI*, *fig.* 10.

Mr. Dacosta, in his *Natural History of Fossils*, p. 249, notices a fossil of similar characters, which he informs us was found in the island of Sardinia; he describes it as a stone "of a dull, brownish, fleshy yellow colour; of a fine glittering, compact, uniform texture; not heavy, and moderately hard.

This kind is thick set with large stars, which generally are of the size of silver pennies. They are not tubes, but are composed of loose or naked thick longitudinal plates, which are disposed from their centre to their circumference. These plates or rays are not equally produced from the centre of the stars, but are of different lengths: nor are they regularly disposed in regard to their starry radii, for often two rays join at the centre and bifurcate at the extremities.

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[*] Silesia Subterranea, tab. XVIII, fig. 11.

The number of rays or plates to each star or coralloid body, also differs very much; some having twelve, others thirteen, and others all the intermediate numbers to twenty; but none have less than twelve. These plates are lodged quite perpendicularly with respect to the surfaces of the mass, and are not intersected, as in the madrepores in general, by any transverse septa or diaphragms. They are of a pale yellowish colour, and are composed of a coarse, glittering opaque spar.

The whole mass is capable of a good surface, though of but a middling polish; and notwithstanding the curious appearance of the stars, which are large and fine, yet on account of its dulness of colour, and indifferent polish, it is not a very beautiful stone."

The curious and uncommon external shapes which some of the madreporites from Langtonwold assume, are worthy of a separate description; a specimen before us, measures upward of eight inches in length, and three inches in diameter, at the base—the form approaches to that of a pyramid, the sides of which are entirely studded over by large projecting tubercles, rising from a circular base, into a kind of cone, with a rounded apex, causing corresponding depressions—the apices of the several protuberances incline toward the blunted extreme of the pyramid, which is also similarly decorated with the sides—some of these excrescences are dichotomous, and trichotomous; yet in these cases, the blunted conical formation is well preserved—upon the whole, the fossil has a botryoidal aspect; or may be compared to a knotted club.

To the naked eye, the whole exterior seems to be closely punctated—with the assistance of a lens, these punctations are discovered to be the central depressions of innumerable crowded multiradiated subangular stars, the margins of which are considerably elevated—the radii are but little waved, yet they frequently bifurcate, and never anastomose with those of the adjacent stars—to the exterior of this particular specimen, serpulites and various fragments of marine shells are attached.

The component matter, is a hard, compact, bluish, or greyish white calcareous substance, strongly impregnated with silex—the exterior, is coloured by an infiltration from the red clay stratum, in which this fossil was discovered.

Nor is this madreporite confined to the particular shape we have just been describing; we have seen it in the form of pretty regular cylinders, rounded at one extreme, or variously rugose, by annular excrescences, or knobbed projections; some transverse sections of the cylindric fossils of this kind, show the tubuli of the stars, radiating from a point nearly in the centre.

On Langton-wold, also, we have procured specimens of a madreporite, bearing externally, the exact representation of a bunch of grapes—the base of these fossils, measures in general but a third of the opposite extreme, so great is the divergency of the projecting rounded tubercles—the stars are round, thick set, small, composed of six bifurcating radii, the interstices are porous.

This fossil is composed of whitish chrystallized spathose matter, the tinge of the exterior is reddish.

It is from a madreporite of this description that the stratified masses of the limestone of Ayton, of an amazing extent, derive their origin, and which still exhibit its peculiar configurations.

The colour of this limestone is commonly a greyish, or bluish white; the exterior, is a dull reddish, or brownish yellow—the nodules, also, which are called *round-heads,* are similarly pervaded by these organic remains; the colour of these is a bluish, or greyish white, strongly impregnated with silex.*

On making a section of this limestone, perpendicularly to the stratum, and bringing it to a surface, numerous stripes, or bands of a regular and similar curvature, will be discerned traversing it horizontally—the breadth of these stripes rarely exceeds the eighth of an inch; they are nearly equidistant; though sometimes three or more of them will be found in some parts of the specimen, to be nearer to each other than the rest—the intervening space varies in different specimens, from the third of an inch, to upward of two inches in breadth; on viewing it with a lens, it will be found to be crossed by frequent slightly diverging striæ; the stripes, also, are marked by striæ, still more minute.

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* Minerals, p. 17.

By alternately wetting, and drying a specimen of the less compact kind, and by applying a slight blow, we easily separated the fossil into laminæ, the breadth of each being equal to that of the striated interstice.

The superior surfaces of the laminæ were regularly mammillated; the inferior surfaces were indented by concavely hemispheroidal impressions corresponding with the mammillæ of the laminæ, next in succession.

The entire upper surface was enriched by crowded, small, circular, concave stars, possessing six bifurcated radii; these stars, however, are frequently obscured by exceedingly minute, pellucid, calcareous chrystals.

From the foregoing observations, it is evident that these calcareous masses owe their existence to a proliferous madrepore, which is increased by a fresh series of stars, germinating from the centre of the disks of those of the previously formed stellated surface—Fougt * has shewn that the *madrepora ananas* was similarly augmented.

The mode of increase of several of the proliferous madrepores, is carried on by a conical process, which arises from the centre of the disks of the stars, which are joined at their margins, with its apex downward, and exhibiting on its base, a star of a similar construction, from which it originally germinated; and this accounts for the presence of the pellucid, calcareous chrystals, which distinguish the undulating stripes of the Ayton limestone; for it is plain that the madreporite, when in a recent state, must have been very porous, and particularly so at the different stellated surfaces, the stars being concave, and not filled up by the pointed apices of the conic stellated germinations; now, during the process of mineralization, the calcareous matter, which pervades the whole, would naturally become filtered, as it percolated through the madrepore, and would chrystallize in the pores—the striated interstices displayed in the sections, under our examination, are nothing more than the lamellæ forming the stars—the regular undulations arise from the sections of the mammillated protuberances.

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* Amænitat. Acad. fig. 8, No. 2.

The breadth of the stratum, at Ayton, sometimes exceeds two feet, which, upon a moderate computation, contains no less than a series of forty stellated surfaces.

The whole mass bears indelible marks of the ravages of the *mytilus lithophagus,* being in some places bored through in all directions by the cylindrical perforations of that shell—this as we have elsewhere* observed, adds fresh evidence to the supposition of the pelagian origin of this stratum.

This stupendous accumulation of the labours of an animal, so apparently insignificant, as the madreporean polype must strike every one with astonishment—to this day, the exertions of this animal are producing the most surprising effects—we read† that there are numerous small islands, within the tropical seas, but little elevated above the surface of the sea; these are the works of marine zoophytes, which raise on all sides their calcareous matter, from which at length are formed rocks and stony shallows, very dangerous to navigators; easterly winds being most prevalent in these seas, the animals as if actuated by instinct, endeavour to exclude the waves driven by the winds, by means of their stupendous works; and therefore carrying on their habitations, they extend them in long arms, which at last unite in a circle, within which they include a portion of calm, untroubled sea.

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* Fossil Conchology, p. 122.

† Dissertation on India, by Dr. Reinhold Forster.

In the coral banks themselves, sand is collected by the waves, affording soil and aliment for the seeds of shore-plants, brought thither by the sea; and these plants at length perishing gradually, create and accumulate a vegetable mould.

Thus, as Dr. Shaw observes in his *Zoological Lectures*,[*] we perceive that the coral tribe, however insignificant it may at first appear, is one of those powerful engines in the hand of the Author of nature, which can produce the most stupendous effects from the most seemingly weak and unpromising agents.

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[*] Vol. II, p. 213.

*Basaltiformed madreporite*; the *lithostrotion, sive basaltes minimus striatus et stellatus*; the *lithostrotion*, or stellated basalt in miniature of Lhywdd,* who has so named this fossil from the resemblance it yields to the stupendous basaltic columns in the county of Antrim in Ireland, commonly known by the appellation of the *Giant's Causeway*.†

Volkmann in his *Silesia Subterranea, cap. IV, sect.* 47, *p.* 120, has designated this fossil, *Corallium Arachnion, Astroites arachnoides, s. telis quasi araneis obtextus, pentagonus, Astroites vorticalis*; from a conceived assimilation it may be said to have to the web of a spider, or a vortex—this fossil is the *marmorides columnaris stellatus, Lithostrotion dictus*, of Da Costa;‡ Dr. Woodward, also, in his *Catalogue of the Fossils of England, C. b.* 84, *a. b.*

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* Lithophilacii Britannici Ichnographia, Epist. v, tab. 23.

† Whitehurst's Theory of the Earth, pl. VI, fig. 1.—Philosoph. Trans. vol. XLVIII, p. 1.

‡ A Natural History of Fossils by Emanuel Mendes Da Costa, F. R. S. &c., vol. I, part I, p. 246.

107, has been very particular in his description of this stone.

The colour of this madreporite is generally here a cherry-red, or a dull brownish yellow—when it is of the former tinge, the limestone is ever of a close uniform texture, and is susceptible of an excellent surface—when it is of the latter shade, it is very porous, and invested in the cavities by drusy calcareous, and sometimes quartzose chrystals: Both these colours are sometimes diffused through the specimens.

The whole fossil is constituted of a congeries of perpendicular, polygonal columellæ, all closely concreted together—they are sometimes, however, variously sinuous and broken, as is the case with most extraneous fossils of this kind—these columellæ differ much as to their number of angles, the pentagon is the most frequent—some of them have four, six, or seven angles.

There is no difficulty in separating one or more columellæ from the rest, if the mass have been previously heated, and then projected into water; the sides are regularly, and finely striated lengthways, and transversely ridged; some of these ridges are very sharp and projecting, so that the columellæ have a rugged aspect; the sides are not always flat, but are sometimes concave in the middle.

Da Costa* informs us "when the apices, or tops of the columns, happen to be complete, they are hollowed or concave; and a prominent star, one third of the dimensions of the concave rises out of the axis of the apex;" we have not hitherto been able in any of our specimens to detect this singular conformation.

Nothing can exceed the elegance of the transverse polished sections of the columellæ—by their close apposition, they form as it were a filamentous polygonal net-work, the meshes of which are respectively decorated by numerous minute radii, proceeding from the centres of the figures, and intersected by several concentric circles of similar tenuity—polished longitudinal sections exhibit the perpendicular lamellæ, forming the stars, which are crossed by frequent transverse ones; so that they have a juncated, or reedy appearance.

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* Nat. Hist. of Fossils, p. 247.

Nor are these specimens of the *lithostrotion*, which have by some process been divested of the matrix, destitute of beauty; the thread-like radii, and the concentric circles render the comparison, which Volkmann has made of this corallite, to the web of a spider very close—see *tab. XVIII*, *fig.* 5, of this work above quoted.—Mr. Parkinson's delineations, fig. 3, 6, of *pl. V*, *vol. II*, *Organ. Rem.*, are admirably correct.

The *lithostrotion* has often been considered as an *astroites*, a term which is given to corallites, having their stars collected together; but upon the whole, the distinction seems to be useless.

Of *FASCICULATED MADREPORITES*, with terminal stars.

*Madrepora anthophyllites.* A fasciculated madrepore, with cornuformed, smooth, curved branches, ramifying from each other.

The exact form of this coral, as figured by Ellis and Solander, *Nat. Hist. Zooph. tab. XXIX*, is preserved in many of the detached masses of a brownish, or blackish marble, on the beach here.

The corallite, is composed of branches pretty smooth, slightly striated longitudinally, shapen like a crow's horn, curved and bowed after the same fashion, and ramifying from the tip; the star is round, formed of equal lamellæ, radiating from a central axis—the sections of the marble in which the madreporite is lodged, exhibit stars, varying much in size, as might naturally be expected, since it is plain that the stars will differ accordingly as the section is made higher up, or lower down, in the cornuformed branch.

This stone is capable of an exquiste polish; the branches are sometimes saturated with silex.

*Madrepora musicalis.** A fasciculated madrepore, composed of cylindric, striated, distant tubes, combined by numerous transverse membranes.

The recent coral is depicted and described by Ellis, in the *Philosophical Transactions, vol. LIII, tab. XX, fig.* 14, *p.* 432, and by Dr. Borlase, in the *Natural History of Cornwall, tab. XXVII, fig.* 7, *p.* 241. The madreporite we refer to this coral, coincides with it in many of its characters—it consists of a fasciculus of numerous, straight, and nearly parallel, erect, cylindrical tubes, of the thickness of a crow's quill, these tubes are delicately, longitudinally striated, and are connected by frequent horizontal processes like tubes, which are but one third of their diameter—the precise construction of these connecting bodies, on account of their minuteness, we have not been able to determine; they certainly have great similitude to the membranes of the recent analogue.

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* Lin. Syst. Nat. 1278, No. 27.

The star is constituted of straight radii, diverging from the centre of the tubes, to the sides. This fossil is generally imbedded in a dark brown limestone, the madreporite being filled with a whitish spathose matter; it is sometimes imbued with silex.

*Madrepora flexuosa.*[*] A fasciculated madrepore, with striated, and somewhat scabrous, cylindrical tubes, bending inward, and then uniting with concave stars, and equal lamellæ.

A madreporite of no uncommon occurrence on the neighbouring shores, is doubtless the mineralized remains of this coral; it is composed of scabrous, longitudinally striated, ramifying tubes, which are generally much twisted—the ramifications, however, are by no means so frequent as those in the recent coral, neither have the concave terminal stellations ever been observable in any of the specimens we have seen, nor indeed, is it to be expected, since the corallite is ever lodged in masses which suffer much from attrition.

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[*] Lin. Syst. Nat. 1278, No. 29.

The limestone containing these remains, is of various colours, as brownish, blackish, reddish, or yellowish, sometimes two or more of these colours are diffused through the stone; it is capable of a high polish. The star, formed of the equal perpendicular lamellæ, is elegantly manifested on the polished sections—the corallite which has been discovered in some small, nearly transparent fragments, of a deep yellow chalcedony, belongs to to this species—some beautiful specimens of this kind, from the coast, are in the cabinets of the curious.

The recent analogue is depicted in Ellis's and Solander's *Natural History of Zoophytes, tab.* XXXI, *fig.* 5; *fig.* 6, of the same table, and exhibits a fragment, displaying the terminal stellated surface; see also, Fougt.*

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* Amænitat. Acad. tom. I, tab. IV, fig. 23, p. 96.

In defining this coral, Linnæus and Ellis* essentially differ; the former describes it, *stellis convexis striatis*, the latter, *stellis concavis, lamellis æqualibus;* Ellis is of opinion that the *madrepora cæspitosa*, and *m. flexuosa* of Linnæus, are the same, the margins of the stars of the latter being destroyed in the fossil subjects; of this description, probably, is the fossil figured by Parkinson, *Org. Rem. vol. II, pl. VI, fig.* 8, and which he describes, as possessing stars of a subglobose form.

*Madrepora fascicularis.*† A fasciculated madrepore, formed of slightly, diverging, small, straight, cylindrical tubes, manifesting on their longitudinal sections, thick-set transverse diaphragms or septa. This fossil has vulgarly been designated *Quill-stone.* The transverse diaphragms are the distinguishing characteristics of this species. It is generally imbedded in a greyish limestone; the tubes are saturated with whitish spathose matter, with silex rarely. Woodward and Volkmann have described similar fossils.

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* Nat. Hist. Zooph. p. 151, No. 6.

† Lin. Syst. Nat. 1278, No. 30.

Among the madreporites of Malton, we have remarked one which has great affinity to the *madrepora carduus* of Ellis and Solander, *Natural History of Zoophytes, tab. LIII.*

It is a dichotomous madreporite, with the branches regularly sulcated longitudinally, but never muricated as in the madrepore; the stars are regular, being formed by nearly perpendicular lamellæ, which we have never seen denticulated. The branches are nearly cylindrical, and vary from two to three inches in circumference, and which are encircled by irregularly elevated bands. The constituting matter, is a pure, translucent, white, carbonate of lime, generally in a state of chrystallization—in some specimens, the interior is entirely destroyed, and is hollow.

In the madreporite delineated *pl, V. fig.* 1, from the same neighbourhood, there is certainly great resemblance to the variety *B* of the *madrepora angulosa* of Ellis and Solander;* the specimen is not dichotomous, but trichotomous which is the case with the recent analogue, figured *tab. XXXIV.*

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* Nat. Hist. Zooph. p. 153, No. 9.

by the abovementioned authors. In speaking of specimens of this kind, it is observed that "these are often trichotomous, which is particularly the case in the variety *B*."

The sides of the branches are longitudinally sulcated, as in the preceding madreporite, but they are not transversely marked—the terminal stars, like the madrepore, are irregularly sinuous—the margins are round, and strongly ribbed by the lamellæ—the branches are short and diverging, coinciding with the variety *B*.

The component matter is a pure, white, translucent, calcareous spar—provided the lamellæ were serrated, the agreement between the coral and the corallite would be complete.

The last description of the madreporites we propose to examine, are the *mycetitæ coralloides* of Woodward, the *compound madreporites* of Parkinson. The few specimens we have had the opportunity of seeing, cannot be said to be either porpital, or turbinated; the external shape is *fungiform*. The superior surfaces of these fossils are oblately hemispheroidal, convex, and completely covered over by stars slightly sunk, with numerous waved radii, which anastomose with those of the neighbouring stars—the inferior surfaces are concave, with a cylindrical, projecting pedicle in the centre, from which, well defined, delicate, thread-like, diverging striæ, proceed to the margin, these striæ are elevated by concentric, rugose swellings, sometimes surmounted by wart-like excrescences; the agreement of the shape of this fossil, with that of a common mushroom, is very remarkable. The component matter is generally a hard, compact, bluish limestone, strongly imbued with silex—from the Malton limestone.

The numerous calcareous detached masses of stone, containing the organic remains of shells, corals, &c., and which Mr. Da Costa has termed *marmorides*, are very abundant on the adjacent shores; after what has been said respecting the different madreporites, any further description may appear useless—in many instances, however, the coralloid bodies are so much distorted, or pervaded by extraneous matter, that the original structure is nearly lost, so that they form variegated marbles, which are not destitute of beauty; on this account therefore, we shall enumerate some of the most striking.

A marble of a deep black or brownish colour, with innumerable coralloid bodies of extreme tenuity, placed nearly parallel to each other, and never ramose—the tubules are filled with a coarse, opaque, yellowish, or whitish, spathose substance—some of them exhibit the laminated construction of the madreporean corallites.

This stone is noticed by Da Costa, *Natural History of Fossils, vol. 1, part 1,* p. 244. Dr. Woodward* also informs us, that similar fossils were discovered on the shores near Scarborough, and from the shores of the river Humber, near Paul, in Yorkshire.

The *marmorides nigrescens durus coralliis refertus* of Da Costa, is very common here. The colour of this marble is blackish, but other shades are frequently diffused through it; it is capable of a high polish: various testaceous remains, and nearly straight, cylindrical madreporean tubes, of the thickness of a goose quill, placed parallel to each other, and striated longitudinally, will be discovered imbedded in it. The tubes are filled with a shining, whitish, calcareous spar.

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* An attempt towards a Natural History of the Fossils of England, in a Catalogue of the Fossils in the collection of J. Woodward, M. D. A. e. 27, 29.

The ramose fragments, which are sometimes discovered in variously tinged masses of the limestone of the coast, exhibit on their longitudinal sections, the lamellated formation of the madreporite, crossed horizontally by transverse diaphragms—these stones were, by the earlier oryctologists denominated *junci lapidei*, reed-stones, and were considered by them to be petrified reeds. Dr. Woodward mentions these fossils—*Catalogue of Fossils, E. k.* 17. Parkinson describes a similar fossil *Org. Rem. vol. II, p.* 64, which he has delineated *pl. VI, fig.* 3. This particular construction is, however, very common in many madreporites, which vary much in their external conformation—it is discernible in ramose, and cylindric corallites of different thicknesses.

Of the existence of the genera *Cellepora, Isis,* and *Millepora,* in a state of mineralization in this district, we are entirely ignorant.

## *III.* Of the mineralized remains of the *ALCYONIUM.*[*]

Perhaps no class of bodies has been so little understood, as the Alcyonia, whether we contemplate them in a recent, or in a fossil state—by Cæsalpinus and other authors of early date, they were conceived to originate from the froth of the sea—by others they have been confounded with sponges—Count Marsigli,[†] Donati,[‡] Ellis,[§] and other celebrated naturalists, have shewn that they differ essentially from them, and are to be considered as a distinct class of marine bodies.

In a mineralized state, these bodies have been consigned to a terrene origin, and several ingenious oryctologists have thought them to be petrified figs, pears, funguses, &c.; among these we find Scheuchzer* and Volkmann†—indeed the external, and sometimes the internal construction of these fossils, has a surprising resemblance to the terrestrial fruits abovementioned.

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[*] Lin. Syst. Nat. 1293, No. 342.

[†] Histoire Physique de la Mer.

[‡] Essay on the Natural History of the Adriatic Sea.

[§] Philosophical Transactions, vol. LV, p. 280.—Essay, on the Nat. Hist. of the Corallines, &c., on the coasts of Great Britain and Ireland, p. 82.—Nat. Hist. Zooph. p. 173.

The alcyonium is a zoophyte, growing in the form of a plant, and is composed of a fleshy, gelatinous, spongy, or leather-like substance, having an outward skin full of cells, with angular openings like little mouths, which send forth polype suckers, through which the eggs are produced; the whole is fixed to other bodies by a pedicle.

It is certainly a matter of admiration how bodies so constituted, should be found in a fossil state—the fleshy, gelatinous matter soon becomes putrid, and when placed in a moist situation soon rots away.—Mr. Parkinson, from an elaborate examination of the opinions of various authors, draws the following ingenious inference, which will in some measure elucidate this mystery.—"It appears (says he) as we have seen from the observations of

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* Lithographica Helvetica.

† Silesia Subterranea.

Marsilli and Donati, that these animals have blended with their gelatinous and carneous substance, innumerable minute spiculæ, which may be considered as the bones of the animal. These manifest themselves by the pricking sensation they occasion on being handled, which has obtained for some of these animals, the name of the sea-nettle. That these spiculæ, formed of a hard and durable matter, may, in some, and especially that the spongy fibres, and coriaceous covering may, in others, keep up the form of the animal, for a sufficient time to admit of the petrifactive process being accomplished, seems to be not improbable; and indeed, appears to afford a satisfactory mode of explaining this curious fact."

*Alcyonium digitatum;* dead man's hand, or dead man's toes of Linnæus* and Ellis.†

This is a whitish substance between flesh and sponge, divided into lobes, the surface of which is covered by angular cells, which have a retiform capable of an exceedingly high polish; from the circumstance of the fossil being invariably of a lighter or darker hue than the matrix, the finely reticulated conformation is satisfactorily displayed. Agatized specimens have also occurred, the colour of these is reddish, and but slightly translucent: a thin slab of this kind placed before the solar microscope, presents a most curious and interesting picture.

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* Syst. Nat. 1294, No. 5.

† Corallines, pl. XXXII, fig. a, A, p. 83.—Nat. Hist. Zooph. p. 175.

The numerous siliceous fossils of Bridlington-bay are undoubtedly referable to the alcyonium—it is very singular that these fossils agree nearly with those M. Guettard describes,* which were discovered in Touraine in France; we shall divide them, into *fungiformed, ficoidal,* and *elongated,* which latter kind, by the earlier fossilogists, was denominated *priapolithi,* which term, M. Walch in Knorr's work has also adopted.

These fossils primarily were imbedded in the calcareous strata of the neighbouring cliffs, from which they have fallen, and are now scattered on the shore in tolerable plenty.

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* Essay, Sur quelques corps Fossiles peu connus. Mem. Acad. Paris, 1757.

The fungiformed species, in many of its varieties, is the exact model of the mushroom; so much so, indeed, that when the internal construction is destroyed it would be impossible to point out a specific difference: the actual existence of fossil mushrooms, has been much disputed, and we strongly suspect, that several of the fossils from Shepey, which Dr. Parsons* describes as fossil fruits, funguses, &c., are the mineralized remains of the alcyonia, particularly those depicted in *tab. xv.*

Of *Fungiformed alcyonites.* The external form of this species varies much, being either convex, flat, or concave; and this causes corresponding variations in the inferior surface; for, when the upper surface is convex, its margin folds in, and the under surface becomes concave, as in a fungus; the pedicle, also, which answers to the stalk, is cylindrical and centrally situated: when the upper surface is flat, the under surface is nearly so too, the pedicle in this case, also, is cylindrical, but seldom is placed in the centre; but inclining toward

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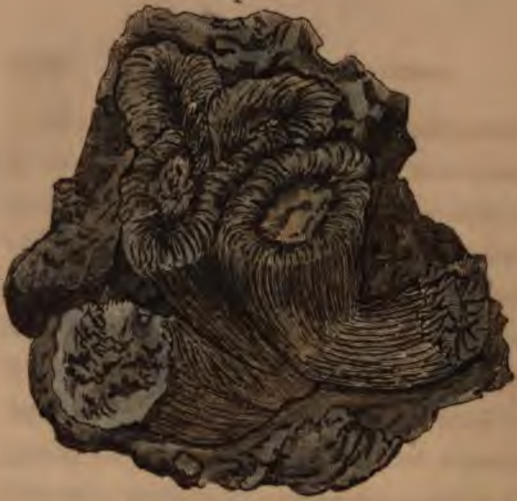
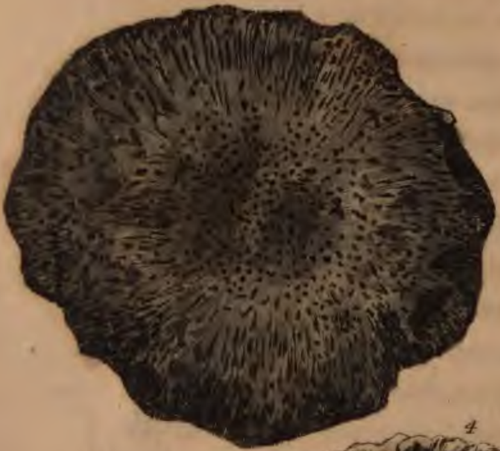
* An account of some Fossile Fruits, and other bodies found in the Island of Shepey. By James Parsons, M. D. F. R. S. Philosoph. Trans. for the year 1757, vol. L. p. 396.—tab. xv, xvi.

1



2



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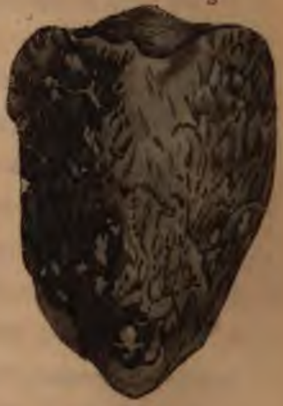

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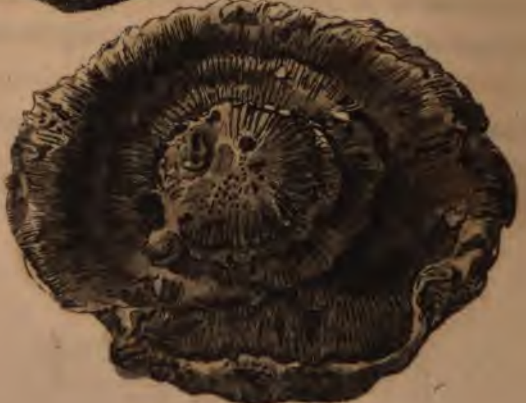

Kersley delt

one side, the margin is rounded: when the upper surface is concave, the under surface assumes a conical shape; in this instance the fossil does not give a bad representation of a funnel.

The superior surface of all these varieties, is richly decorated by the fine spongose, reticulated, contiguous mouths, which characterize the alcyonia—the inferior side, is regularly marked by close, waved, delicate fibres, proceeding from the summit of the pedicle, to the extreme bordering margin; these fibres by repeated inosculations, render an appearance, which has some relation to that of the upper surface; in general, the inferior surface is made very uneven by rugose swellings, which assume a species of rude, concentric arrangement, around the pedicle—these are frequently studded by wart-like excrescences.

An uncommonly perfect specimen of the species in question, is depicted *pl. v*, *fig.* 2, 4; it was discovered almost entirely enveloped in a rolled mass of the chalk-stone, the greater part of which was easily removed by a graver; the specimen was then immersed in a strong solution of muriatic acid; a most violent effervescence took place, and in a few hours, the fossil, which is entirely siliceous, was quite disengaged from the matrix.

Figure 2 of the above plate, represents the superior surface, with reticular markings, which are as well defined as those of a recent alcyonium. Fig. 4. exhibits the inferior surface, with the pedicle and wart-like excrescence, in a state of high preservation—upon taking this specimen from the acid, we were surprised to find the under surface suffused with a beautiful purple tinge, which it still retains in great measure.

Of *Ficoidal alcyonites.* The figure of these fossils, upon the whole, approaches to that of a fig: the exterior is rough, and covered over by a curious reticulation, caused by a casual ramification of numerous, raised, sinuous lines or fibres, denoting the spongy alcyonic texture; these fossils have most probably terminated at the lower extreme, in a point, or have had a pedicle laterally ramifying; but, hitherto, we have not met with a single specimen that retained a trace of the pedicle.

In the midst of the upper end, is a conical depression, similar to that in some terrene fruits.

A longitudinal section of a fossil of this kind, is delineated *pl. v, fig.* 3; the curious filamentous fibres we mentioned as covering the outside, are here seen proceeding irregularly from the pedicle to the sides, and to the edges of the conical depression, forming an elegant retiformed surface. This fossil is entirely constituted of a brownish coloured flint; some fragments of alcyonites, of a like kind have been discovered on the beach here.

Of *ELONGATED ALCYONITES.* The alcyonites of this description, are by far the most numerous, and are sometimes of very large dimensions. The form, is nearly that of a cylinder, which generally tapers toward one extreme, sometimes pretty regularly, so that the aspect is conical, sometimes abruptly; this extreme, however, is never acuminated, but is blunt and rounded—it is also bowed, and rendered variously rugose, by annular protuberances, warts, and knobs.

The broad end of some of these fossils, measures upward of four inches across; its margin is much rounded; a circular perforation passes through the midst of the fossil, traversing it from end to end, of a diameter, one third of that of the fossil, and gradually diminishing with the exterior; it rarely perforates the narrow end.

The use of this aperture, was doubtless for the reception of sea-water, which probably was for the support of the zoophyte, and which, perhaps, performed the same office that the stomach does, in animals of a more perfect nature.

The exterior of the greater number of these remains, is covered by the reticular texture, which we have observed before, is peculiar to the spongy formation of the alcyonia; but specimens of this kind are by no means perfect, and have lost a most curious part of their organization.

The fossils when complete, are invested by a fine, thin cortex or cuticle, which, to the naked eye appears quite smooth, but with the assistance of a lens it will be found to be perforated by an infinite number of minute, circular openings, arranged over the whole surface, as closely as possible to each other—this cortical part when recent, must have been a fine spongeous substance; it is now like the rest of the fossil, entirely siliceous.

On examining a polished transverse section of one of these bodies, we perceived numerous meandering fibres, radiating from the edge of the circular aperture to the cortex; the interstices between the fibres, were filled with a friable, white, carbonate of lime; a longitudinal section was immersed in muriatic acid; the intervening calcareous matter was soon destroyed, and the fibres which pervaded the whole fossil, and which lined as it were the interior of the cylindrical perforation, presented an appearance, exactly agreeing with the vesicular structure of bones.

As to the cylindrical fossils which bear marks of alcyonic organization, and which are perforated entirely through by a circular bore, we at present consider them to be the fragments of those alcyonites, which had sometime terminated in a blunted apex.

If we had any doubt respecting the real origin of these bodies, the Malton fossil, figured *pl. IV*, *fig.* 3, would afford us every satisfaction. Two of the cylindrical bodies in question, are there seen in a state of adhesion, to a fragment of an *ostracite*—the superior terminations exhibit the circular aperture, observable in the siliceous fossils of Bridlington; the exterior, also, is reticulated by a congeries of ramifying filaments—in every respect, the agreement between the fossil from Malton, and those from Bridlington, is complete.

The specimen depicted, is but of small size, the cylinders scarcely measuring two inches in length; it is composed of a dense carbonate of lime: the Bridlington specimens vary from two inches to fifteen in length, and from half an inch to four inches in diameter at their broadest extreme.

In some specimens from Bridlington, we have remarked a construction so very different from the preceding, that they may be considered as a distinct species. In the place of the circular openings, we find four, seven, or twelve, which upon making a longitudinal section will be found to be the terminations of as many contiguous, and somewhat angular tubes—in other repects, these bodies agree with the preceding.

In the siliceous nodules and pebbles which occur on various parts of the coast, will frequently be detected a fibrous organization, which is most likely referable to some marine zoophyte of the alcyonic kind.

*IV. ENCRINITES.*[*] The origin of these bodies was formerly a matter of controversy among oryctological writers; some referring them to the vegetable, others to the animal kingdom—it would be useless indeed, to recount the various arguments produced on both sides,[†] since certain marine zoophytes have been discovered, which, although they do not precisely agree with the fossil subjects, yet they are indubitably a variety of them.

M. Davila had in his possession a recent zoophyte of this kind, a description of which is given in the *Memoirs of the Academy of Sciences at Paris, for the year* 1755—in the Hunterian museum, now at Glasgow, was preserved a recent specimen, taken on the coast of Barbadoes, which is particularly described by Mr. Ellis in the fifty-second volume of the *Philosophical Transactions*—a similar specimen is in the possession of the Royal College of Surgeons, of London.

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[*] Lin. Syst. Nat. tom. III, p. 169, No. 21.

[†] See the works of Ray, Lister, Hellwing, Harenberg, &c. also Buttner, Leibnitz, Lhwydd, Mylius, &c.

The zoophyte found by Capt. Adrianz on the coast of Greenland, figured by Ellis in his *Natural History of Corallines, pl. XXXVII,* was supposed to be a species of the (*lilium lapideum*) lily encrinite, the resemblance, however, is very slight.

The encrinite may therefore be defined as the mineralized remains of a marine zoophyte, consisting of a stony trunk or stalk, formed of cylindrical, oval, or pentagonal vertebræ, articulated with each other by surfaces marked with striæ, disposed in stellated or radiated figures; this vertebral column supports a pentagonal base (or what is called a pelvis by some) from which proceed five arms, terminating in fingers and numerous tentacula. These bodies are generally termed *ENCRINITES* when the articulating vertebræ are cylindrical or oval, and *PENTACRINITES* when they are pentagonal.

No fossil bodies perhaps, are so universally diffused, and so much disorganized as the encrinites, and it is on this account that their fragments, in different countries, have obtained various names; among the Germans they are designated *Roedersteines,* from the striæ of the articulating surfaces of the vertebræ being arranged like the spokes of a wheel; *Bonifacius Pfenninge,* St. Bonifacius's money; *Spangersteines,* from being compared to beads; *Muhlsteines,* from being like mill-stones; *Hunuthrœnens,* giant's tears; they have also by some been named *Lapides caseiformes,* cheese-stones, and *Modioli lapidei,* from resembling a bushel measure—when the sides of the vertebræ are convex, they have obtained the names of *Caditæ, Volvolæ doliatæ,* and *Volvolæ utriculatæ,* from being formed something like casks—also *Rotulæ lapideæ,* from resembling wheels.

In this country they are termed *Witch-stones,* or *Witch-beads, Fairy-stones,* and *Saint Cuthberts-beads,* by which latter appellation Walter Scott celebrates them.

"..............On a rock by Lindisfarn
Saint Cuthbert sits, and toils to frame
The sea born beads that bear his name,
Such tales had Whitby's fishers told,
And hear his anvil sound,
A deaden'd clang, a huge dim form,
Seen but and heard when gathering storm
And night were closing round."

MARMION, *Canto II*, v. 16.

Among oryctological writers, these stones are known by the terms *TROCHITÆ* and *ENTROCHITÆ*, from the greek word *(trochos)* which signifies a wheel.

The *Trochitæ* are defined as circular stones of varous thicknesses, with flat, concave, or convex surfaces differently marked, and perforated by a central hole or foramen—when two or more *trochitæ*, or single vertebræ are united together, the series is termed an *entrochite ;* the above terms are applicable only to the circular and elliptical vertebræ.

Numerous, indeed, as are these interesting remains we have never heard of one single instance in this district, of the occurrence of the head, or superior terminations of the arms—nay, the vertebral processes are universally so completely dislocated, that we have seldom seen more than ten of them in a state of union. From the great number of the trochitæ, which are to be met with here, more variety of species might have been expected; upon turning to the *Tentaminis de Lithozois ac Lithophylis Prodromus* of the ingenious Rosinus, it will be found that the species are numerous; the specimens we have seen, differ chiefly in the central foramen; in some it is one third of the diameter of the disk of the vertebra, in others, scarcely one eighth of it.

The trochitæ and entrochitæ nearly constitute in many instances, considerable blocks of marble * of various colours, which occur on the adjacent shores; they are also imbedded in masses strongly imbued with pyrites. Many specimens of a translucent yellow chalcedony, containing these bodies, transmuted into a similar substance, have also been met with; these are capable of an excellent polish, and are extremely beautiful fossils; detached silicized trochites and entrochites have been found in the gravel-heaps on the beach—from the decay of the matrix these bodies are often seen in relief.

As to the *PENTACRINITES*, or those encrinites with pentagonal vertebræ, several specimens of some of their species have been met with, in a tolerably perfect state.

A species of this kind which Mr. Parkinson has so happily named the *BRIAREAN PENTACRINITE*, and which he has delineated in his *Organic Remains, vol. II, pl. XVIII, fig.* 1, is by no means uncommon in the neighbourhood of Whitby.

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* Minerals, p. 46, No. 32.

A specimen before us shows the numerous arms composed of articulating vertebræ, proceeding from every part of the main vertebral column, and dividing into innumerable others, which gradually taper, so much so, that the extreme terminating vertebræ are nearly points—"the first ramifications Mr. Parkinson observes, may be said to be completely dichotomous, but of the subsequent innumerable ramifications, a correct idea can only be obtained by a view of this part of the animal, or its representation;" some specimens exhibit the arms of these astonishing organic productions in relief, from a partial decomposition of the matrix, which is generally a limestone of various colours, and strongly impregnated with pyrites.

The single vertebræ of the pentacrinites are denominated *Asteriæ*, star-stones; *Stellariæ*, and *Lapides stellares;* the vertebral columns are called *Asteriæ columnares*,* columnar star-stones; by the Germans they are designated *Sternsteines*.

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* Lin. Syst. Nat. tom. III, p. 168, No. 18.

The *Asteriæ* have the articulating surfaces on both sides, decorated by five elliptical areæ, formed by very minute ridges, which are so arranged as to constitute a star; the centre is perforated by a minute hole.

These vertebral fragments have been found in the blue loamy clay of Knapton; in a stratum of bluish clay, near the low-water mark in Bridlington-bay; some of these exhibit very distinctly on their sides, the points of articulation of the lateral ramifying vertebræ; the component matter is generally spathose; we have seen them on the beach here, transmuted into a translucent, yellow chalcedony.

***Screw-stone.*** A slight attention to the construction of the entrochi will sufficiently account for the existence of these curious fossils; and show, that they are nothing more than casts of those columns. The form is cylindrical, composed of double convex substances, like lenses, joined together centrally: it is plain, therefore, that such construction would create an appearance something like a *screw*, hence the name; a closer inspection, however, will show that this term is misapplied, since the fossil presents the exact resemblance of a series of *pulleys.*

There is considerable variation, both in the diameter of the disks, and the distance between the edges of the lenticular substances, in different specimens; the diameter of some, being scarcely a third of that of others, the distance of the edges varies also, in a like ratio; in perfect specimens the disks are ornamented by minute diverging striæ.

These fossils were formerly considered as the exuviæ of some animal, the recent analogue of which was unknown; or a species of strombites. The column is always placed in a cylindrical cavity, the diameter of which ever exceeds its own, sometimes very considerably; the sides of this cavity are marked by slightly elevated, equidistant rings, which, as well as the cavity, are easily accounted for.

The cavity surrounding the column was formerly occupied by the entrochite, which being constituted of more perishable materials, than the stony particles held in solution by the aqueous menstruum, which had subsequently insinuated itself into the cavities of the columns, had decayed, leaving the cast of its interior; as to the slightly elevated rings that we observed above, they are the impressions of the exterior of the columns, showing the points of articulation of the vertebræ—it often happens in specimens of this fossil, that the entrochite will be observed filling up some part of the cavity, its decomposition not having been completed.

The *screw-stone* is most commonly of a deep brown colour, very porous, and sometimes impregnated with iron—the constituting matter is for the most part siliceous.—This species is by no means common.

# Part Fourth.

# FOSSIL VEGETABLE REMAINS,

&c.

# FOSSIL VEGETABLE REMAINS.

It would be exceeding the limits of the present work to enter particularly into the different theories, which have been proposed to account for the changes which take place in organized bodies.

*Substitution* (or a process by which the original form of the organized body is preserved, the mineral or inorganic matter gradually introducing itself during the removal of the organic particles,) was corresponding with the original ligneous texture, is tolerably well preserved; externally, knots, branches, &c. are commonly to be seen—it is for the most part compact; when it is porous, the cavities are lined with quartzose chrystals. From the fracture, translucency, and lustre of this fossil, it appears to be wood penetrated by common silex, held in solution by an aqueous menstruum. In general this fossil-wood takes a good polish—several interesting specimens have been discovered in various parts of the coast.

*Chalcedonic fossil-wood.* The colour, is greyish or bluish white, or brownish or brownish yellow—the insterticces are filled with a pure whitish or yellowish pellucid chalcedony, which generally assumes the blistered or mammillated form; the lustre is dull; the fracture, fine splintery, rarely conchoidal.

It is by no means common in the district; a few specimens of peculiar beauty have occurred; in these instances the chalcedony has not only thoroughly permeated the minutest fibres of the original organic substance, but has coated over the entire mass.—From the shores of Mill-bay and Speeton.

*Agatized or Agatine fossil-wood.* This species of fossil-wood is formed by an infiltration of agate, and assumes nearly all the characters of that fossil.

The colour is various, as brownish, greyish, whitish, reddish, &c.—in the same specimen the concentric increments of the growth of the wood, are of the different shades we have enumerated in gradation; in the heart of some of the masses of this kind, a fortification agate has been formed, the organic structure being totally destroyed.

The agatine fossil-wood of the district is generally porous, and has its interstices invested by quartz chrystals; it is sometimes perforated by nearly parallel pipes, which are filled by a whitish, pure, siliceous matter; this particular construction probably arises from the fistular texture of the wood, from which the fossils of this description are derived. The fracture borders on the conchoidal; translucent on the edges—gives fire to steel plentifully—occurs in rolled pieces.

A fragment was discovered imbedded in a mass of yellowish siliceous grit on the coast here, the colour was light ash-grey, the clefts, which were numerous, were filled up by a bluish white pellucid agatine substance, the woody texture was very distinct: we were induced to mention this specimen from its pointing out in some measure, the probable matrix of agatine fossil-wood. Compact specimens are capable of an exceeding high polish. From the adjacent shores, and from those of Whitby and Bridlington.

*Jasperized or Jasperine Fossil-wood.* Its most common colour is flesh-red, it is also a dark-brown, which varies much in intensity—the lustre is invariably dull—fracture, conchoidal, sometimes fine splintery—it has no translucency. The texture is close, and some specimens are capable of a high polish. The ligneous conformation is sometimes very plain; the exterior, however, never shows either knots or branches. It occurs in rolled pieces.

Dr. Kidd, in his *Outlines of Mineralogy, vol. 1, p.* 209, remarks that "In some cases this appearance (ligneform) is the result of the original formation of the substance: in others, it seems to have arisen from the actual depositions of siliceous, in the place of vegetable matter. The following distinctive mark has been given, by which, to ascertain the real origin of this jasper. In petrified-wood, not only the concentric circles of the original vegetable are present; but also, the vessels or fibres which extend from the centre toward the circumference."

Mr. Parkinson* holds a very different opinion respecting the origin of jasper in general; and in concluding his thirty-fifth letter, observes "that most jaspers owe something in their composition to vegetable matter, changed by those processes to which it was necessarily subjected after the universal deluge."

The best specimens have hitherto been found on the beach here, at Carnelian and Mill-bays, Speeton and Bridlington; those we have seen from the neighbourhood of Whitby, are coarser and less compact, from the greater proportion of alumine, which enters into their composition.

Many of the masses which have been considered jasperine-wood, seem to have greater relation to *hornstone,* and may be termed *Hornstone-wood*:

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* Organic Remains.

the colour of these is commonly yellowish; the fracture is splintery, some varieties incline toward an ash-grey shade, and bear great affinity in most of their characters to conchoidal hornstone; these are commonly traversed by veins of silex.

*Calcareous Fossil-wood.* The colour is generally brownish—fracture, straight or hackly—lustre, glistening—very porous.

The calcareous matter has insinuated itself into every fibre, and is commonly chrystallized, so that upon the decomposition of the masses of this kind, the organic structure of the wood is preserved by the chrystals investing the principal fibres; forming, if we may be allowed the expression, the skeleton of the wood.

Calcareous fossil-wood of the above description is frequently discovered in the limestone of Ayton, Seamer, and Malton.

In the chalk-rock of Flamborough some masses have occurred, which are undoubtedly wood impregnated with lime, the colour of these is whitish; tolerably compact, and mostly traversed by veins of silex—sectile—sometimes nearly friable, and soils the fingers like common chalk.

*Aluminous Fossil-wood.* This is the most common species of fossil-wood the coast produces; it is to be met with in great quantities in the alum-works in the neighbourhood of Whitby, in those at Stow-brow and the Peak, and on the beach in the immediate vicinity of Scarborough.

The masses in the aluminous shale are sometimes of considerable bulk—in the form of large trunks of trees, in flattened and ramose pieces—prodigious masses of aluminous earth often present this fossil-wood arranged in veins with it, or lineated with pyrites and jet.

Colour, when free from the impregnation of the ferruginous oxide, bluish, sometimes blackish; when impregnated, it is reddish brown, or darkish bistre brown—it will frequently be seen on making a fracture, that the centre of the mass will be bluish, the rest reddish; showing the progress of the ferruginous infiltration.

Fracture, chiefly slaty—internally, the lustre is dull and earthy—pretty hard and heavy—generally interspersed by veins of pyrites and calcareous spar—shows externally and internally the texture of wood.

The entire fossil is sometimes completely invested by a pyritous or bituminous crust, which latter is an inferior species of jet.—Aluminous wood is generally susceptible of an exquisite polish.

What certainly adds great interest to many specimens of the fossil-wood of this kind, is that various testaceous remains are commonly adherent to them, as ostracites, ammonites, &c., so much so indeed, that the cavities between the diaphragms of Nautilites, Ammonoides, and Ammonites, have been filled by these ligneous remains.

M. Davila, Dr. Scheuchzer,[*] and M. Walch,[†] have noticed corresponding specimens.

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[*] Oryctogr. Helvetica, p. 210.

[†] Recueil des Monumens des Catastrophes que la Globe la Terre á essuiés, &c. tom. III, p. 30.

*On Secondary Vegetable Fossil Remains.* These we divide into *Fossil-plants, leaves, stems* or *stalks*, and *fruits.*

Secondary vegetable fossils in this district, exist only in sandstone and argillaceous iron-stone. In the freestone quarries of Falsgrave-moor, Cloughton, Troutsdale, and those in the neighbourhood of Whitby in particular, are frequently discovered the remains of plants and leaves; yet they rarely exhibit any impressions of these bodies, but the outlines of them formed by a bituminous, and sometimes ferruginous stain, incorporated as it were in the substance of the stone; it is owing to this close union of the vegetable stain, or impression with the sandstone, that the plants in many instances, on breaking the mass, will either be in part displayed, or show a transverse section only.

These vegetable relics appear to belong to the fern tribe—some specimens of the above description measure upward of a foot in length.

The nodules of argillaceous iron-stone of Robin-hood's-bay, long since noticed by Dr. Woodward, sometimes contain in their centre the remains of plants; these specimens yield not only the leaves in relief, but manifest the minutest fibres of them; the Doctor says,* "these nodules are called *Cat-heads*, and seem to consist of a sort of iron-stone, not unlike that which is found very plentifully at Robinhood's-bay in Yorkshire." Parkinson† has depicted impressions of a like kind, *pl.* *IV*, *fig.* 1, 2; these impressions also are referred to the ferns. Mr. Da Costa ‡ informs us, that "there are found in some parts of this kingdom, as at Robinhood's-bay in Yorkshire, many curious impressions of the *fern-tribe*, in regular nodules of iron-stone."

The fossil-plants which have been found in the argillaceous iron-stône of Hinderwell-bottoms, to the north of Whitby, assume a prodigious size; the leaves are long and narrow, and deeply striated lengthways, they are pinnately arranged like those of the ferns—a blackish bituminous crust generally invests them.

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* An attempt towards a Natural History of the Fossils of England, in a Catalogue of the Fossils in the collection of J. Woodward, M. D. part II, p. 14.

† Organic Remains, vol. I.

‡ An account of the impressions of Plants on the Slates of Coals, by Mr. Samuel Mendes Da Costa, F. R. S.—Philosophical Transactions, vol. L, part I, p. 228.

Impressions of leaves similar to that figured by Parkinson,* *pl. v*, *fig.* 5, have occurred in nodules of argillaceous iron on the beach here.

The remarkable vegetable impression delineated by Da Costa, in *tab. v*, *fig.* 1, of the fiftieth volume of the *Philosophical Transactions*, and which was obtained from a colliery at Drilt, near Oswestry in Shropshire, in the black coaly slate which occurs immediately over coal-pits, has been discovered on the surface of some compact masses of siliceous grit on the coast of this neighbourhood.

The impressions exhibit a series of rhombuses, arranged like the meshes of a net, but not so regularly; in the centre of each is a depression of a rhomboidal shape. The specimens we have seen of this description, have suffered so much from exposure to the atmosphere, that the bituminous crust, which generally invests fossils of this kind, was destroyed, the peculiar features of the fossil, however, were well preserved.

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* Organic Remains, vol I.

Dr. Woodward has described some specimens in his *Catalogue of English Fossils, B. pp.* 106, 107, *spec q.* 22, *and q.* 32, which though not exactly the same, yet bear great affinity to the fossils in question. The rhomboidal work led him to suppose that they might be the impressions made by vegetables of the fir kind. Volkmann* has figured a branch with rhomboidal work on it, which has some relation to the impressions of this coast.

Among fossil vegetable relics, the *stems* and *stalks* of plants and reeds have ever been numerous—their various forms, and their remarkable external conformations evince that the number of species must have been very great; yet very few of them can properly be assigned to any known species whatever.

Several specimens before us coincide with the fossil which Volkmann has depicted, *tab. XIII, fig.* 7, of his *Silesia Subterranea*, and which he has referred to the common sugar-cane (*Arundo Saccharina*); indeed these fossils bear great resemblance to that reed—the component matter is a micaceous grit, having its surface invested by a thin coaly crust—Mr. Parkinson* ingeniously explains this circumstance. "The plant," he says, "having been surrounded by the soft, or fluid materials, of which the sandstone has been since formed, its internal succulent part would soon waste away, and its place be filled with the soft magma; whilst the more sollid and ligneous epidermis would remain, and, after a time, would give its correct impression to the surrounding lapidifying matter. Then passing through the bituminous change it would fill its own mould with its own altered substance, forming such a surface as the surrounding stony matter would adhere to but slightly; and would therefore dispose to that separation by which its form is displayed."

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* Silesia Subterranea, tab. XXII, fig. 2.

The length of some of the specimens of this kind exceeds five feet, exhibiting the jointed processes, and terminating sometimes in a rounded knob—these fossils occur in great abundance at Hawsker-bottoms to the north of Robinhood's-bay.

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[*] Organic Remains, vol. 1, pp. 433, 434,

A fossil jointed stem or reed occurs also in the same place, with a regular, striated, or ribbed surface; Parkinson[*] has delineated a similar fossil *pl. 111, fig. 3.*

In the argillaceous iron-stone of the neighbourhood, we have seen two or more joints of a fossil reed analogous to the common *Bamboo;* M. Walch has noticed a fossil of this kind. Mr. Whitehurst,[†] also, speaking of the strata incumbent upon coal whether argillaceous stone or clay, says they contain a great variety of vegetables, or the impressions of them, and particularly the Bamboo of India, striated and jointed at different distances.

There are scarcely any fossil vegetable impressions that have excited so much attention as those cylindrical masses of sandstone, which Mr. Whitehurst, from their external markings, has assimilated to the *euphorbia* of the East-Indies.

These fossils differ much in size, varying from four inches to fifteen in circumference, and from three inches to two feet in length. The form is seldom completely cylindrical, but is generally much compressed. The constituting sandstone is of different degrees of compactness, and invariably contains micaceous particles—it is generally of a greyish colour, some specimens are reddish from the infiltration of iron.

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[*] Organic Remains, vol. 1.

[†] Theory of the Earth, p. 203.

The entire surface is decorated by thickest papillæ, which are placed in a circular depression, so that their apices do not project above the surface; these papillæ are regularly arranged in quincunx order.

A cylindrical body will be seen inclining toward the compressed side, and passing directly through the fossil, with a rough, striated surface, and of a diameter, one sixth of that of the outward body; this was by Dr. Woodward* considered as the medulla of the plant at first, but he was led afterwards to imagine it the beginning of a germinating process; these assertions, however, rest upon no solid foundation, as there is no recent vegetable which can be said to be analogous to the fossil in question.

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* Catalogue of Fossils, part II, p. 60.

Mr. Da Costa seems, in his paper in the fiftieth volume of the *Philosophical Transactions, p.* 231, to have given up the idea of referring the vegetable impressions which, he there describes, to any recent vegetable, and remarks, "as these remains of vegetables are very extraordinary, I would recommend to the curious in botany, to take notice of them as an *Appendix Plantarum adhuc incognitarum.*" Mr. Parkinson, who has been very particular in his description of this fossil, a specimen of which he has delineated *pl III, fig.* 1, of the first volume of his *Organic Remains,* concludes his remarks with the following observation. "Unable to find sufficient points of correspondence between it and any plant which is now known to exist, we must be satisfied with Dr. Woodward, whose opportunites for judgement, from the multitude of his specimens, perhaps exceeded those of any one else, to submit to leave it among the *fossilia incognita.*"

Several excellent specimens have been discovered in the neighbourhood; the surface of some of them was covered by a black bituminous matter, in all of them it was visible in the hollows around the papillæ—the internal cylindrical body is always invested with bituminous matter.

We should have deemed it unnecessary to have said any thing respecting fossil-fruits *(carpolithi)*, had we not seen some pyritous masses, having the exact external shape of those bodies: some of them resemble figs, others lemons, pears, &c.

These fossils have by many been considered as the remains of the fruits, whose form they assume, but we confess, it seems more probable that they are rather the accidental forms of the pyrites.

In the neighbourhood of Bridlington, specimens of this kind have been found, which agree precisely with those from the isle of Shepey, which Dr. Parsons has figured in the fiftieth volume of the *Philosophical Transtactions, tab. xv, fig.* 1, 3: he says, "These two bodies appear to be figs, petrified when hard and green; being, as I have just observed, then capable of receiving the pyritical particles with which they are manifestly impregnated. One is more perfect in its form than the other; and they are now shooting their salts, and will soon fall to pieces."

An examination of the pyrites of Wharram-Percy will clearly show that the various globular, botry-

# FOSSIL BONES.

In treating of the mineralized remains of animals, we shall begin with those which have occurred in the most perfect state, and then proceed to the examination of detached parts.

Mr. Charlton in his *History of Whitby*, relates that "About the year 1743, the Rev Mr. Borwick, found in the Alum-rock, the complete skeleton, or petrified bones of a man; but though the utmost caution was used it was broken into many pieces, and greatly mutilated before it could be taken out.

"In the year 1758, the petrified bones of a *Crocodile*, (an animal that was never known in our seas) were taken out of the rock, under the cliff; and these, though broken in many pieces, were sent up to the Royal Society.

"About the year 1762, the skeleton, or petrified bones of a horse, were found in the Alum-works at Saltwick, at the depth of about thirty yards under ground, which were taken up with much care, though not without being considerably broken; they were afterwards sent to the University of Aberdeen.

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"In the year 1750, a complete ossification was found on the north side of the East Pier, not far from the Cliff. It was taken up in the sea by a gentleman who was then bathing, and appeared to be part of a human skeleton, consisting of three ribs, with the flesh between them. There were also on the outside thereof, some remains of skin, the pores of which might be readily discerned; but this skin was not in an ossified state; for, after being kept some years, it entirely mouldered away into dust."

We confess we are not aware that any particular description has been given, either of the fossil human skeletons, or that of the horse abovementioned; as to the former remains, they like the *(Homme Fossile)* of Dr. Scheuchzer, are perhaps nothing more than an unknown, and probably extinct, gigantic species of salamander or proteus; that this is the case with Scheuchzer's specimen, is clearly shown by the learned M. Cuvier, in *Les Annales du Museum d'Histoire.*

The only authentic fossil human skeleton is that lately brought from Guadaloupe, by Sir Alexander Cochrane, and which is figured in the *Philosophical Transactions.*

The mineralized remains of the *Crocodile* above noticed, are so clearly and particularly described in the fiftieth volume of the *Philosophical Transactions,* and as they form so prominent a feature among the extraneous fossils of the district, we shall take the liberty of extracting the entire account, adjoining at the same time the engraving which accompanies it, and conclude the whole by a statement of the various opinions which have been held respecting them, by different naturalists.

* "*An Account of the Fossile Bones of an Allegator, found on the Sea-shore, near* Whitby *in* Yorkshire. *In a Letter to* John Fothergill, *M. D. from Capt.* William Chapman.

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* Part I, No. XLII, p. 688.

Whitby, 20th of 1st mo., 1758.

"A few days since we discovered on the sea-shore, about half a mile from this place, part of the bones of an animal, appearing as in the annexed figure (plate VI). The ground they laid in is what we call alum-rock; a kind of black slate, that may be taken up in flakes, and is continually wearing away by the surf of the sea, and the washing of stones, sand, &c., over it every tide.

"The bones were covered five or six feet with the water every full sea, and were about nine or ten yards from the cliff, which is nearly perpendicular, and about sixty yards high, and is continually wearing away, by the washing of the sea against it; and if I may judge by what has happened in my own memory, it must have extended beyond these bones less than a century ago.

"There are several regular strata or layers of stone of some yards thickness, that run along the cliff, nearly parallel to the horizon and to one another. I mention this to obviate an objection, that this animal may have been upon the surface, and in a series of years may have sunk down, to where it lay; which will now appear impossible, at least when the stones, &c. have had their present consistence."

*References to the Draught.*

A, B, C, the head and bill, not in the same line or range with the rest of the bones.

*a, b.* A bone, with its processes, which I take to be similar to that which includes the brain in fishes. The part between the bone and outlines, appeared to be a smooth membrane; but was so thin, that in taking up it broke.

B, C, the superior *maxilla* intire, and in some places covered with the inferior one for four or five inches together, when this happens, the vacuity is filled with matter like the rock in which it lays; and there are large teeth in each jaw, at such distances and so posited, that those in one jaw fill up the vacuities in the other, and appear like one continued row, the mouth being shut.

"Where there is only the superior *maxilla* remaining, there are no teeth; but the sockets are visible and deep, and at the same distance from each other as the teeth in the other part of the jaw. The tip or extremity of the bill was intire for four or five inches, having both *maxillæ* with their teeth, and towards the point large fangs.

"Part of the bill and head were covered with the rock, which was removed before they appeared as in the figure.

A, D, F, G, cavities in the rock, about two inches deep, where, I suppose, the wanting *vertebræ* have laid, as they are exactly suited to have received them.

D, F, ten *vertebræ* from three to four half inches in diameter, and about three inches long, some of them separated in taking up. They were about two inches in the rock.

E. Here we observed something like bone to stretch from the *vertebræ*, and intending to take it up whole, begun to cut at what we thought a proper distance, but found we cut through a bone; and with the *vertebræ* brought up three or four inches of the *os femoris*, with the ball covered with the *periosteum*: but the animal has been so crushed hereabouts, that we could make little of the socket or *os innominatum.* Several of the ribs came up with the *vertebræ:* they were broke, and laid parallel to the *vertebræ;* but not quite close, there being some of the rock between them. The *periosteum* is visible on many of the bones.

G, H. Twelve vertebræ remaining in the rock, with which they are almost covered, especially towards the extremity.

"The place where these bones lay, was frequently covered with sea-sand, to the depth of two feet, and seldom quite bare; which was the occasion of their being rarely seen: but being informed that they had been discovered by some people, two or three years ago, we had one of them with us upon the spot, who told us, that when he first saw it, it was intire, and had two short legs on that part of the *vertebræ* wanting towards the head.

"Although we could not suspect the veracity of this person, we thought he was mistaken; for we had hitherto taken it for a fish. But when we took it up, and found the *os femoris* abovementioned, we had cause to believe his relation true, and to rank this animal amongst those of the lizard kind: by the length (something more than ten feet) it seems to have been an allegator; but I shall be glad to have thy opinion about it.

I am thy friend,
William Chapman, Sen.

*The bones were sent up, and are herewith presented to the Royal Society, by*

J. Fothergill.

* *A description of the fossil Skeleton of an animal found in the Alum-rock near* Whitby, *by* Mr. Wooller. *Communicated by* Charles Morton, *M D. F. R. S.*

"It is in this rock that the Ammonitæ, or Snake-stones, as they are commonly called, are found, which have undoubtedly been formed in the *exuviæ* of fishes of that shape; and though none of that species are now to be met with in the seas thereabouts, yet they in many particulars resemble the Nautilus, which is well known.

"The internal substance of these stones, upon a section thereof, appears to be a stony concretion, or muddy spar. Stones of the same matter or substance, in the shape of muscles, cockles, &c. of various sizes, are also found therein, and now and then pieces of wood hardened and crusted over with a stony substance, are likewise found in it.

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* Part II, No. CVIII, p. 786.

"Many naturalits have already observed, that among the vast variety of extraneous substances found at several depths in the earth, where it is impossible they should have been bred, there are not so many productions of the earth as of the sea; and it appears by the account of authors both ancient and modern, that bones, teeth, and sometimes entire skeletons of men and animals, have been dug up or discovered in all ages, and the most remarkable for size, commonly the most taken notice of.

"In the first particular this skeleton will most probably appear to have belonged to an animal of the lizard kind, quadruped, and amphibious; and as to its size, much larger than any thing of that kind ever met with or found in this part of the world; though, from the account of travellers something similar is still to be met with in many of the rivers, lakes, &c. of the other three.

"When the annexed drawing thereof was taken January 5, 1758 (*see* pl. VI.) there remained no more of there *vertebræ* than is therein expressed; that is, ten between D and F, and twelve between G and H: but when it was first discovered, about ten years ago, they were complete; and there was besides the appearance of what was then thought to have been fins, near the back part of the head at A, the same as appeared further backwards at E, when this design was made.

"The *vertebræ*, &c. now wanting having been either dug up by curious persons, or washed away by the violence of the waves at high water, and the accidental beating about of stones, sand, &c. during that time; the water covering this skeleton several feet at high water in spring tides; the cavities in the rock still remaining as in the design.

"The substance of the bones, with their *periosteum*, on the covered or under side, in most parts remains intire, and their native colour in some places in a good measure preserved, and the teeth with their smooth polish plainly to be discovered. Part of the mandible near the extremity was covered with a shelf of the rock about three inches thick;

which being removed, both the mandibles appeared under it complete, with the teeth of the upper and under one, plainly locking or passing by each other. These appeared to be of the *dentes exerti* or fang kind, as well as all the others in the narrow part of the mandible, and further backwards they were not observed.

"From this ledge or shelf the mandible towards B, is single, and appears to be the upper one of the living animal; and from the head not being exactly in the line of the body, that part has been inverted, or twined quite over, and the body itself, as appears from the transverve processes of the *vertebræ*, lies on the right side. There appears one row of teeth only on each side of the mandible, and they are about three fourths of an inch asunder.

"The mandible BA, the *cranium* g. *h*, and the *vertebræ* from D, to E, were attempted to be taken up whole; but the bones being rendered extremely brittle, and the rock in which they were fixed being a brittle blackish slate, with joints or fissures running in every direction, would not hold together: the whole therefore fell in many pieces, the *vertebræ* in the joints only, which makes them easy to join together again, and besides shows very plainly the transverse and spinal processes thereof, with the foramen in the latter for the spinal marrow.

"It was now that a piece of the *os femoris*, about four inches long, showed itself in the sparry concreted substance at E, together with a piece of the *os innominatum*, to which it had been articulated or joined. This, with what has been before remarked, will sufficiently prove this to have been an animal of the quadruped, and probably, from the shape of the cranium peculiar to fishes, of the amphibious kind. At the same time many pieces of *costæ* or ribs, as broke and crushed up against the *vertebræ*, were plainly visible.

"The cavities of all the bones were filled with a substance, which appeared the same as the rock itself; and the substance on each side the *vertebræ*, as they laid, was a mixture of sparry concreted matter with that of the rock itself, which is a blackish slate. The animal, when living, must at least have been twelve or fourteen feet long. And the dimensions of the whole, or particular parts of the skeleton, may be measured from the scale annexed thereto.

"This skeleton lay about six yards from the foot of the cliff, which is about sixty yards in perpendicular height, and must have been covered by it probably not much more than a century ago. The cliff there is composed of various *strata*, beginning from the top of earth, clay, marle, stones both hard and soft, of various thicknesses, and intermixed with each other, till it comes down to the black slate or alum-rock, and about ten or twelve feet deep in this rock, this skeleton laid horizontally and exactly as designed.

"The probability, that this cliff had formerly covered this animal, and extended much more into the sea, is not in the least doubted of by those that know it. The various *strata*, of which it is composed, are daily mouldering and falling down; and the bottom, being the slaty alum-rock, it is also daily beat, washed and wore away, and the upper parts undermined, whence many thousand tons often tumble down together.

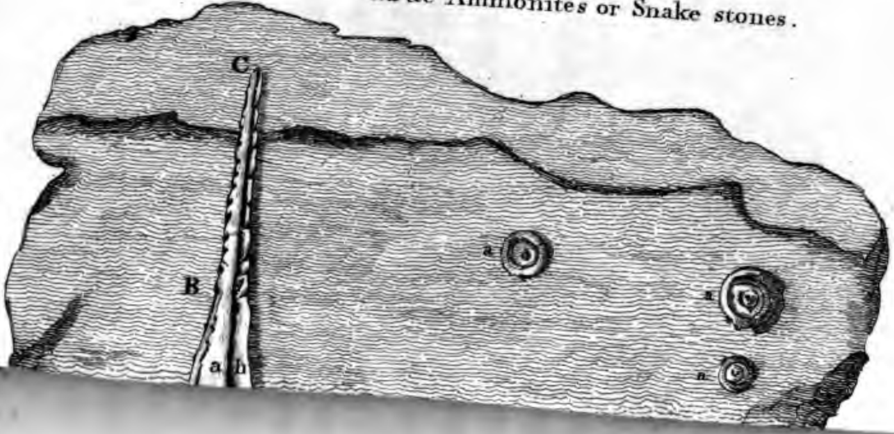
"Many ancient persons now living, whose testimony can be no way doubted of, remember this very cliff extending in some places twenty yards further out than it does at present. In short there is sufficient evidence, that at the beginning it must have extended near a mile further down to the sea than it does at present; and so much the sea has there gained of the land.

"These are the principal facts and circumstances attending the situation and discovery of this skeleton; which from the condition it is in, and from the particular disposition of the *strata* above the place where it is found, seem clearly to establish the opinion, and almost to a demonstration, that the animal itself must have been antidiluvian, and that it could not have been buried or brought there any otherwise than by the force of the waters of the universal deluge.

"The different *strata* above this skeleton never could have been broken through at any time, in order to bury it, to so great a depth as upwards of one hundred and eighty feet; and consequently it must have been lodged there, if not before, at least at the time when those *strata* were formed, which will not admit of a later date than that abovementioned.

"P. S. In the *XLIX* vol. page 639, of the *Philosophical Transactions*, an animal described by Mr.

aa &c Ammonites or Snake stones.



Edwards, which was brought from the Ganges, and resembles this in every respect. He calls it *Lacerta (crocodilus) ventre marsupio donato, faucibus Merganseris rostrum æmulantibus.*"

It is difficult to conceive how M. Faujas St. Fond in his *Essais de Geologie, I*, p. 360, could consider this skeleton that of a *Physeter,* and describe it without arms or legs, in direct opposition to what has been so clearly proved respecting the existence of the *os femoris* and the *os innominatum;* the *Physeters* have teeth in the lower jaw only.

Camper also thought that these fossil remains belonged to a species of *Balæna;* but the large pointed teeth alternately arranged in both jaws and the fangs, entirely confute his supposition, since the *Balænæ* it is well known have no teeth whatever.

The celebrated Mons. Cuvier in *Les Annales du Museum d'Histoire, tom. XII,* observes that the skeleton of a crocodile, discovered at the bottom of a cliff of pyritical slate, about half a mile from Whitby, by Captain William Chapman probably belongs to one of the two species of fossil crocodiles discovered at Havre and Honfleur, both of which he has placed among the *Gavials*, or *gangetic* crocodiles; the characters of which, are with elongated cylindrical jaws and palmated feet.

An examination of the numerous fossil *vertebræ* of Whitby, will clearly show that skeletons of a similar nature as the above, have at one time been by no means uncommon; and there is reason to suppose that others may yet be discovered.

Perfect detached bones of an immense size, have repeatedly been dug out of the alum-rock in that neighbourhood: ten or more *vertebræ* are sometimes met with in a state of attachment, with the broken fragments of the *costæ* either articulating, or without any order whatever; remains of the *pelvis, scapula,* &c., have also occurred belonging to animals which must have been of prodigious dimensions; these bones generally have the *periosteum,* either entirely or in part remaining; their colour is generally brownish, and their surface for the most part is smooth, and polished in a slight degree.

There is a circumstance which renders the mineralized bones of Whitby highly interesting and beautiful, we mean the presence of pyrites, which has insinuated itself into the *cancelli* of the bones in a surprising manner, so that upon rubbing the specimen down, or by making a fracture, an elegant reticulated surface is displayed; the lustre of this pyrites is highly metallic: sometimes from the permeation of ferruginous matter, the substance of the bones has derived a red tinge; in this case the *cancelli* are commonly filled with a pellucid irridescent calcareous spar; sometimes the whole mass is charged with petroleum, which imparts a blackish colour; in some few instances the bones are penetrated by a siliceous menstruum: in short, these organic remains, by various changes, assume so many modifications that it is impossible to enumerate them.

The fossil bones, in the generality of instances, are accompanied by the *cornu-ammonis, nautili, belemnites,* and numerous other testaceous remains; sometimes the bones are entirely incrusted with pyrites bearing the impressions of these fossils, a sure criterion of their antiquity.

It is not a little extraordinary that among so many remains of animals in this district, scarcely any fossil teeth have been discovered. In the *Philosophical Transactions* we are informed that the teeth of sharks, *lamiodontes*, or *glossopetræ*, as they are sometimes called, have been taken out of a rock in Hinderskelf Park (now Castle Howard), near Malton in Yorkshire; of late years we are not aware of the occurrence of a single fossil of the above description.

The only species of fossil teeth which have been found, are those which occur in the neighbouring cliffs, and at Whitby; they are cuneiform, or wedge-shapen, and sometimes from swelling out in the middle, assume a shape like a lozenge, but broader on the triturating or mastigating surface, than on the opposite extreme—we have seen some specimens measuring upward of six inches in length, three inches and a half in their broadest part, and four inches in thickness.

These teeth are composed of plates of the fourth of an inch in thickness, alternating with others of a third of that thickness; the thicker plates are invariably composed of an apparently compact ivory; the thinner ones of a porous bone, which is ever much decayed, and frequently gives place to mineral impregnation.

These teeth, it is very evident are always much decayed and imperfect, so much so indeed, in some cases, that the plates easily separate from each other, and in all, the external cortical crust is wanting; the masticating surface is sometimes well preserved: the greatest number of plates we have seen in union, have been sixteen; in all probability the teeth, when entire, must have had many more; the thicker plates on their flat surfaces are undulated, and covered with rough longitudinal striæ; hence it is that they have the appearance of fingers; sometimes this resemblance is so close that it is not extraordinary that the lively imagination of a Kircher, or an Aldrovandus, should have considered them *(chirites)* petrified hands; the latter of these authors, however, in the middle of the sixteenth century, referred many of the huge bones which were discovered in various parts of the globe, to the elephant, whilst contemporary and succeeding authors, for some time afterwards, imagined them the skeletons of *fallen angels,* who inhabited the earth previously to the creation of the present race of men: from the remarks of Mons. Cuvier, it is highly probable that the fossil teeth above described, are those of some species of the elephant tribe.

A few years ago the tusk of an elephant was discovered in this neighbourhood, sticking out of the clay of the sea-cliff; the exposed part was much rifted and cracked, the part imbedded was tolerably sound; the length was upward of a foot and a half, and the diameter of the thickest part, five inches; some part of the articulating extreme apparently had been broken of; it was slighty bowed; the ivory was internally, yellowish. At Bridlington also, a tusk was found, this specimen seemed to be in the last stage of decay, it was not only cracked longitudinally, but on making transverse sections, it separated into concentric rings; the colour of the ivory was a clouded mixture of yellow and black, in some parts it was a dingy blue; these sections, notwithstanding, manifested the peculiar structure observed in ivory.

*Fossil Palates.* These are very rarely discovered in this district, in a perfect state: a specimen before us from Whitby, is tolerably preserved. The form is nearly a square, a side of which measures eight inches, the superior surface is remarkably convex.

The entire mass is made up of plates in the form of parallelograms, rounded at their edges, about an inch in length, and three fourths of an inch in breadth; these plates are regularly disposed in rows, overlaying each other like the tiles of a roof, so that upon the defect of one plate, another is at hand to succeed it; the component matter is an extremely hard, brittle substance, of a darkish brown or blackish colour, and when broken is much like horn, and is dull.

The exterior of these plates is highly polished, and has a great resemblance to enamel; the thickness of the plates a little exceeds the sixteenth of an inch.

These fossils are lodged in the compact black alum-stone, sometimes invested with pyrites. Mr. Parkinson, in the third volume of his *Organic Remains*, page 261, describes a fossil palate of a like kind, which he has depicted *pl. xix, fig.* 14, of the same work.

The mineralized remains of the *Fins* and *Scales* of fish have repeatedly been met with enveloped in the aluminous nodules of the beach here; some specimens of the latter have exhibited the bony rays, the ligament and even some remains of the skin.

◆

The very remarkable fossils lately discovered in the compact limestone of Malton, one of which is delineated in the title page of this volume, have excited considerable interest: at one time we were inclined to consider them the mineralized remains of some species of the *Beetle* tribe; but naturalists in general doubt the existence of insects furnished with *antennæ* in a fossil state, at least in their perfect form; it is true that the celebrated Linnæus notices a *petrified Beetle* in the *Museum Tessianum;* but it must be remarked that in the last edition of the *System of Nature,* he has omitted this fossil, probably considering it the *exuviæ* of some other body: whilst the fossil above delineated was in the hands of the engraver, a specimen was sent us from the same neighbourhood, distinctly exhibiting long jointed claws, adhering to the body of the fossil, and nearly coinciding with those of some species of the genus *cancer;* at present, therefore, we have ventured to place these fossils under that genus, until some further information can be gained respecting them, not knowing one more appropriate.

These fossils are composed of a thin crust, of a brownish or blackish colour, which has a tolerable polish, and projects considerably from the substance of the limestone; the upper part is marked by small circular punctations, which assume an irregular quincunx order; these are but thinly scattered on the inferior part.

The extreme, which we consider the head of the insect, on the upper part is round, but tapers with a regular curvature into two sharp processes like *proboscides,* the upper one extending beyond the lower, having the appearance of an upper and lower jaw: the two inner or opposite edges of these processes are finely serrated; the head is articulated to the rest of the body, in the same manner as the claws are in crustaceous animals.

The upper part of the body rises gradually from the point of articulation, and then terminates the posterior extreme in a curve nearly circular; the lower margin is straight.

> These are thy glorious works, Parent of Good,
> Almighty! Thine this universal Frame,
> Thus wond'rous fair! Thyself how wond'rous then!
>
> MILTON.

*References to the Plates of the first volume of the* MINERAL CONCHOLOGY OF GREAT BRITAIN; *by James Sowerby, F. L. S., &c.*

Upper figure, tab. I, is similar to the *Nautilite* described pp. 130, 131, &c.*

Fig. 9, tab. XV, accords with the *Terebratulite* described p. 119, XIV, I.—Mr. Sowerby has named this species *Terebratula semiglobosa.*

Figs. 1, 3, of tab. XVII, and those in tab. XXIV, are referable to the ammonites described pp. 148, &c.

The three upper figures of tab. XXXV, represent the *Murex Corneus* noticed p. 160.

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* This specimen Mr. Sowerby has referred to the *Nautilus Imperialis* rather than to the *N. Pompilius*, supposing the umbilicus to be open; some few specimens have recently been met with near Whitby, having the umbilicus open.

Tab. xlviii, exhibits a fossil nearly the same as the *Ostrea Diluviana*[*] described p. 116.

Tabs. lviii, lx, represent fossils agreeing with the several varieties of the *Orthoceratites* of the coast, see p. 158.

Tabs. lxx, lxxix, show a variety of *Dentalites,* the greater part of which are described pp. 166, 167.

Fig. 1, tab. lxxi, represents the *Turbo Littoreus* mentioned p. 163.

Tab. lxxiii, exhibits *Ammonites* of a similar kind as those described p. 144, No. 2, also figs. 1, 2, 3, 4, 5,[†] of tab. xcii, are described pp. 144, 145, and the *ammonite* in tab. xciii, agrees nearly with the fossil described No. 2, p. 147.

Tab. xciv, shows a fossil similar to that described

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[*] Mr. Sowerby denominates this fossil *Ostrea Marshii;* but he observes at the same time, "*I* may perhaps err when I make this shell distinct from O. diluviana, *Linn.* see p. 104.

[†] This fossil was obtained from Scarborough.

p. 147, IV, No. 1, and the fossil* depicted tab. xcv, is described p. 146, III, No. 5.

Tab. LXXXV, represents a *Trigonia costata* described p. 126.

Tab. LXXXVII, upper figure represents a *Trigonia Clavella* described p. 125.

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[*] This fossil was found at Whitby, and Mr. Sowerby has named it *A. armatus*.

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# CORRIGENDA.

Page 11, line 7, *for* Borchant *read* Brochant.
—— 26, —— 15, & p. 186, l. 7, &c. *for* envelloped *read* enveloped.
—— 46, —— 8 *for* encrinate *read* encrinite.
—————— 11, *for* give *read* gives
—— 50, —— 7. *for* Yeddingham *read* Saltergate.
—— 60, last line but one, *for* preportions *read* proportions.
—— 65, —— 9, *for* Granite *read* Garnet.
—— 68, last line but three, *for* occurs *read* occur.
—— 77, —— 19, *read after* externally *a;* & l. 20, *after* internally *a;*
—— 84, —— 9 *for* mamillated *read* mammillated.
—— 92, last line but one, for *Thoneisenetein* read *Thoneisenstein.*
——102, —— 1, *for* preceeding *read* preceding
——107, last line but three, *for* pl ii, fig. i, *read* pl. i, fig. 3.
——119, —— 3, for *TEREBATULA* read *TEREBRATULA.*
——120, —— 9, for *Terebatulites* read *Terebratulites.*
——122, 134, 200, lines 11, 15, 8, *for* discernable *read* discernible.
——146, last line but two, *for* vulgularly *read* vulgarly.
——150, —— 15, *for* fiiting *read* fitting
——161, 164, 165, lines 11, 5, 1, *for* umblicated *read* umbilicated.
——162, —— 3, *cancel* ———
——163, —— 2, for *uninalve* read *univalve.*
——170, —— 4, for *spires* read *spines.*
——190, —— 15, *for* corrallite *read* corallite
——196, —— 1, *for* assimulated *read* assimilated.
——206, —— 10, *for* mulilated *read* mutilated.
——214, —— 6, *insert* they
——229, —— 1, *for* these *read* those.
——230, —— 3, *for* crow's *read* cow's.
——254, —— 6, *for* varous *read* various.
——260, —— 14, *for* instertices *read* interstices.
——274, in the note, *for* Samuel *read* Emanuel.
——279, —— 8, *for* thickest *read* thickset.
——281, —— 14, for *Transtactions* read *Transactions.*
——302, —— 14, *for* mastigating *read* masticating.